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THE GEOLOGICAL HALL OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

L. P. GRATACAP.

The development in New York of two public museums devoted to art and science has been long watched with interest by all who appreciate the refining and civilizing influences such institutions exert. Yet these museums are insufficiently known to our public, and their educational importance is undervalued. In one of them, the American Museum of Natural History, varied and costly collections are exhibited in a series of halls, each of which illustrates some special department of science.

In the large hall, at the top of the building, the collections of fossils and geological specimens are placed, and so arranged that one can walk through the ages of the world by taking as many steps as would carry him twice the distance of a city block. The visitor starts with the lifeless areas of archæan time and rises through successive stages of animal life, reviewing as he steps from case to case the evolution of new forms, noting the disappearance of old ones, until, through forms more and more closely allied to those of our modern seas and lands, he emerges in the Quaternary upon the traces of man. The dullest imagination is stirred by this mental recreation of the stages of life's unfolding, and the least observant eye watches for the opening links of the zoological chain.

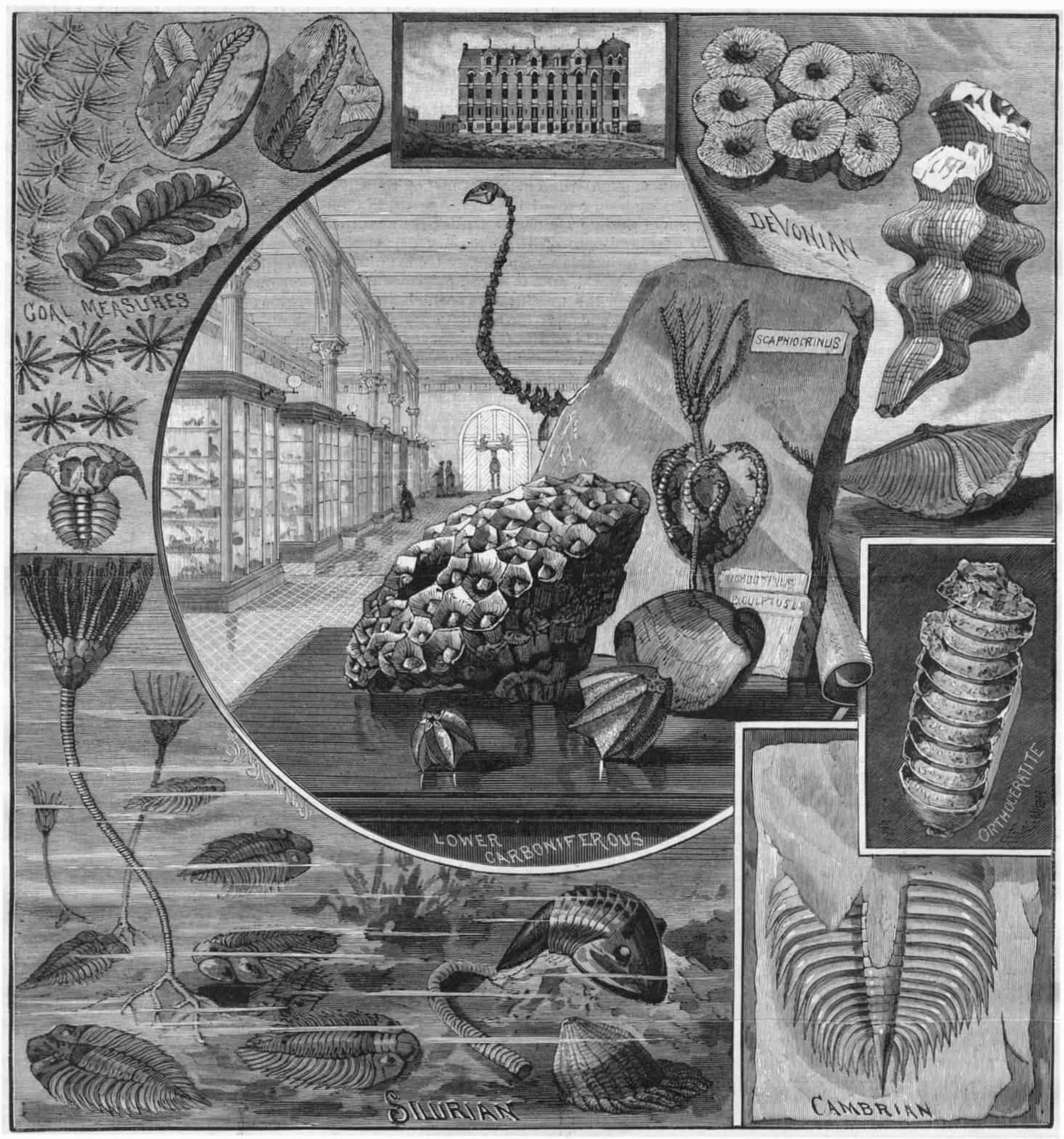
The general arrangement of this series of fossils in their chronological succession, as well as according to their zoological classification, and to some extent so exhibited as to show distinctions between the forms found in different parts of the country, is unrivaled. It has received the highest encomiums, and justly reflects honor upon its curator, Prof. R. P. Whitfield. As we enter the hall we encounter on the left specimens of the various rocks which come from areas of archæan strata, which represent the adamantine flooring upon which the sedimentary rocks of the succeeding ages were laid.

They are crystalline and ore-bearing rocks, devoid of fossils, and typify to us a wonderful period, when the solidifying crust of the young globe was strained, contorted, and wrinkled under the tremendous lateral pressure of the contracting sphere, when the elastic, semi-rigid strata were thrown into flexures, and under the liquefying action of pressure and heat their elements were redistributed, mineral crystallizations formed, and crevices and faults evoked. Although it seems possible that fucoids or sea weeds may have spread themselves in thick sheets along the marine margins of the lands, the evidence of any other kind of life is shadowy and equivocal.

From microscopic study and recent geological surveys, we have learned that over wide areas volcanic forces played their disturbing part in the formation of this primal world. Dikes of intrusive lavas are found widely distributed through the Huronian beds about Lake Superior, in Wisconsin and Canada, while Prof. Hitchcock has insisted that many of the White Mountain peaks in that distant day were active craters, down whose sides poured the extended and liquid materials which have become crystallized and hardened into the granites and greywackes of to-day. It was a period of preparation before the hosts of living forms which filled the later seas were ushered in, and the mysterious processes of life began their course.

With one turn from the side of an alcove to the other we have passed over centuries of time, and find ourselves inspecting the multitudinous remains of trilobites, which in the Cambrian age suddenly and in great numbers made their appearance in the primordial ocean. The trilobite, so named from the division of its body into three sections—the frontal parts or *glabella*, the middle or *thoracic segments*, and the tail or *pygidium*—was distantly related to our modern king-crab, whose cast-off shells are to-day seen strewn along the beaches of Staten and Long Islands.

(*Continued on page* 245.)



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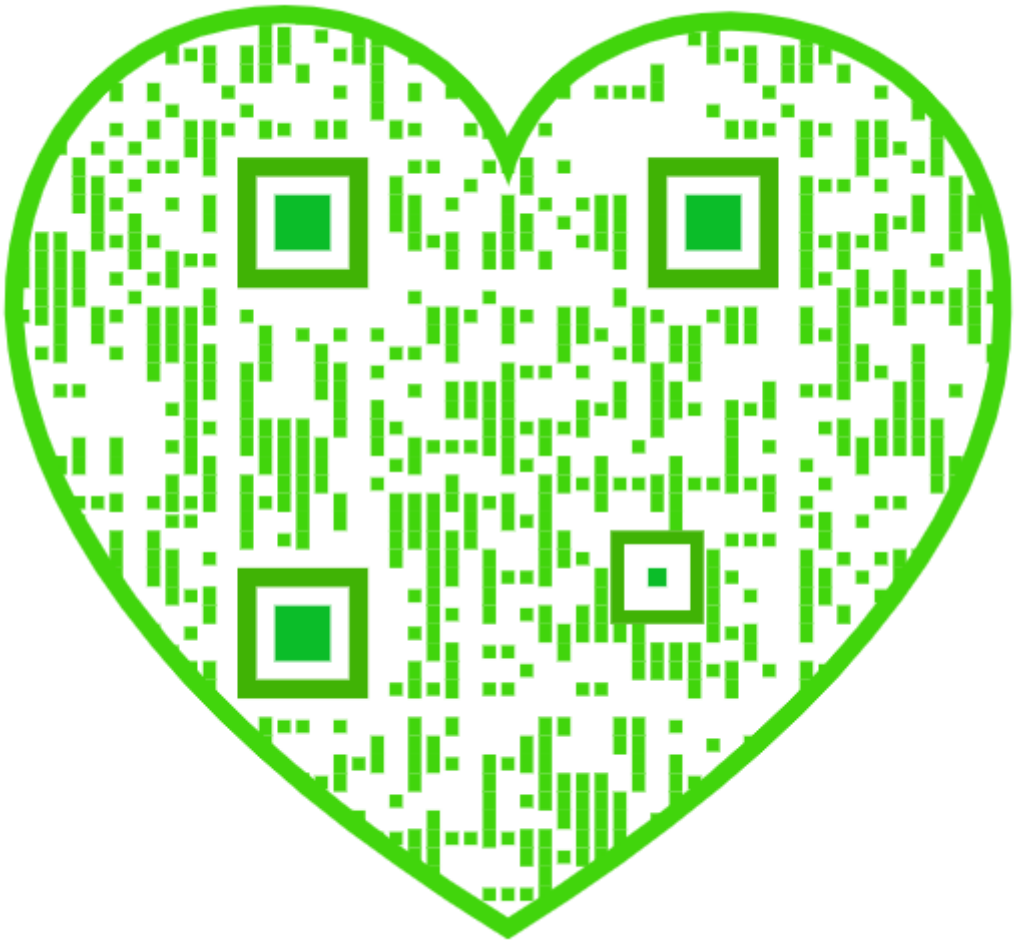

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NEW YORK, SATURDAY, APRIL 17, 1886.

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THE COAST SURVEY.

Those who are familiar with the character of the work performed by the Coast Survey while it was under the direction of Hassler and Bache and Pierce can scarcely help feeling a regret that it has been suffered to fall into its present deplorable condition.

During the administration of these men, the Coast Survey was looked upon as "out of politics," its work conducted on a strictly business and scientific basis, and no officer, whether from the army, navy, or the civil service, could hope to retain his position once incompetency or a lack of diligence became apparent. As a result, the Coast Survey hydrographic charts came to be known for accuracy among navigators the world over; the stranger or the native skipper found it so easy to approach our coast and enter our harbors by their aid that they complained of the laws of compulsory pilotage; and it was an achievement upon which either was justly entitled to pride himself when he discovered a shoal, a ledge, or even a solitary submerged rock not laid down in the Coast Survey charts, or, if there, inaccurately determined. After the death of that noble old man, Prof. Benjamin Pierce, perhaps the greatest mathematician of his time, there was a short interregnum during which the Coast Survey had practically no head; and then came a period of mismanagement, not to use a harsher term, in which politics, for the first time in the history of the Coast Survey, was suffered to exert its malign influences in every branch of the service, when original investigation got no applause and honest industry no reward. This was happily ended by the recent removal of Superintendent Hilgard under serious and, so far as has yet appeared, unrefuted charges.

Curiously enough, the office of Chief of the Coast Survey having been refused by Prof. Agassiz, of Cambridge, son of the late eminent scientist, it was turned over to a subordinate of the Treasury department, who, however estimable a man he may be, is unknown to the scientific world, and, it seems, possesses neither the experience nor the qualifications which are essential to the control and direction of this important work.

Few persons outside of the Coast Survey are aware of the powerful influence which for many years has been working to turn the service over to the departments of War and the Navy—the geodetic work to the one and the hydrographic to the other.

The Engineer Corps of the army, it was urged, was entirely competent to perform the trigonometrical and topographical work, and the sounding out of bays, rivers, and harbors, the locating of shoals and ledges, the observance of tidal phenomena, and the work upon the high seas was alleged to pertain to the proper and professional duties of the navy.

Professors Hassler, Bache, and Pierce succeeded in making out a strong case in opposition to this. They were able to show, with at least sufficient force to convince those who had the power to make the change asked for, that a special training was required to accurately and intelligently perform the work of the Survey, and that those engaged in its conduct should be at least temporarily removed from the influence of "red tapism" and the "circumlocution office," and freed from the restrictions of military discipline.

They showed, by a comparison of work in the field, the difference between that performed by the army and navy officers while with their commands and by these same and other officers while under the direction of the Coast Survey office, in which the superiority of the latter both in quality and quantity was clearly apparent.

But the standard of excellence established by the three noted men whose names have been mentioned it is not easy to maintain; the influence exerted by them in the service itself, and the confidence that was felt in their skill by those without who were interested in its success, none but a very able and experienced and conscientious man could hope to replace.

Once let the old time reputation of the service lessen—it seems now to be on the wane—and its mergence with departments more or less political may be looked upon as likely, if not certain.

RAILWAYS IN CHINA.

Engineers and capitalists have for some time past regarded the Celestial Empire as offering one of the most promising fields for railway enterprises that still remains unoccupied. They have manifested, consequently, a very strong desire to possess it. A dense population and large natural resources give undoubted assurance of success, could the officials who guard the imperial conservatism once be propitiated. But this is an obstacle which the most importunate diplomacy has not yet succeded in overcoming. If one glances at the later history of China, however, her unwillingness to entertain any foreign propositions, without very careful consideration indeed, can readily be understood. The assertion is constantly being made that the empire is about to throw off her orientalism, and to become in effect an annex to Europe, as far as the adoption of western civilization and methods can produce such a transformation. But the change has not come, and those familiar with her modes of thought do not regard it as possible until some years have passed. Her contact with western methods has not shown them to be altogether alluring. From experience, the Chinese officials have come to have a positive dread of the "promoters" of foreign enterprises. They have, unfortunately, been taken in so often by irresponsible adventurers that it is quite possible what we have flattered ourselves has been an opening wedge may be in reality another nail in closing the doors against us.

It is hard to predict what their course will be. We have allowed ourselves to regard them as a very slow people; but while their foreign policy has often only negative merits, it shows in many cases a justice and wisdom of which our own country cannot always boast. We are even now in the midst of a dispute with China in regard to the question of indemnity for the deplorable outrages committed against the Chinese laborers in Wyoming and other parts of the West. We cannot blame China, if the settlement of this question determines the treatment of our own countrymen within the borders of her empire. To injustice, or at least retarded justice, we have now added discourtesy. The Chinese minister and his suite on their entrance into our territory are received, not with the courtesy and attention due to their position, and particularly ordered by the State Department, but with unequivocal marks of disrepect and with churlish demands for credentials. These things must all react upon ourselves. We cannot outrage a nation, however conservative, with impunity. China is not vindictive, but she has shown herself to have a good memory.

She will hardly permit Americans to take any part in the development of her resources while such serious grivances remain unanswered. A statement has recently gone the rounds of the newspapers to the effect that several lines of railways had been determined upon, and that the contracts for materials had been placed in America. It is impossible to find out whether the statement is correct or not, but if such contracts have been made, the present antagonistic attitude of our country will be apt to defeat their fulfillment. It is difficult to know just what they are doing in that conservative empire, for it was only a short time ago that a prominent English journal stated authoritatively that the Chinese were about to introduce foreign systems for working their coal mines, and had arranged with a Belgian firm for the importation of machinery and skilled miners. The statement brought forth a communication from a Chinese employe at the Kaiping Mines, near Pekin, that such a system had already been in use for three years past, a part of the plant consisting of a tramway from the mine mouth to the nearest canal. There is, consequently, a railway in actual operation at the present time. As the outside world is so unsuccessful in keeping informed about what has already been done, its failure to obtain the secret of what the Government proposes to do in the future is hardly remarkable. It requires, however, more than even the reputed amount of American assurance to believe that China will permit a people who have insulted and assassinated her own citizens to take any part in her contemplated improvements until these wrongs have been redressed.

Economy of Fuel.

There is no question that the application of many mechanical devices to locomotives is calculated to effect a saving in fuel, says the *National Car-Builder*. Steam is not used so economically that less could not be made to do the work now done by a greater quantity, and there might be many improvements introduced that would reduce the temperature of the gases being passed into the atmosphere. Skill, ingenuity, and perseverance are, however, required to apply the forms of improvement indicated, and great difference of opinion may rationally exist among accomplished mechanical engineers as to the probable effect of structural changes proposed with the view of promoting economy of heat. But there ought to be no room for difference of opinion about the desirability of accomplishing saving, when all the changes to be effected are the introduction of the means of keeping an accurate record of fuel consumed. It is merely a slight change of method to keep the record of fuel consumed and work done by *enginemen* instead of *engines*, but the curtailment of waste that results from this change is by no means slight.

There is no line of economy in railway management at the present day that promises results equal to that of stopping the rushing leaks resulting from senseless waste of fuel in locomotive firing. We know of no plan that will stop the leakage so effectually as the introduction of the premium system of coal accounts. Putting on traveling engineers well acquainted with the proper methods of firing and fuel saving might do some good if these engineers would insist on their methods being followed. But it is an excessively difficult matter to get enginemen to change the free and easy style they have been brought up to, and which takes no thought of any higher duty than that of getting over the road comfortably. The proper and only effectual mode of inspiring the enginemen with zeal for fuel saving is to make them pecuniarily interested in its results.

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Drum Making.

Of a total of 200,000 drums made in this country last year, it is said that 178,000 were manufactured in Granville, Mass. The old fashioned drum with wooden barrel, which was formerly the only kind in the market, is being rapidly supplanted by the neater and lighter model with a tin barrel. For the manufacture of the latter, tin of various colors is employed, blue and red predominating, though the larger quantity of tin drums are made of a brass imitation. This tin comes in sheets of two sizes, 14 by 20 inches and 20 by 28, the sheets being packed in cases holding 112. The process of manufacture is thus described by the Springfield *Republican:* The sheets are first sent to a knife, which cuts them into various lengths, from which drums of sizes varying from 6½ inches across the head to thirteen inches are made. This done, the strips are each punched with a hole, then secured and tightened together. Hoops are placed on the inside rims, and the barrel is then ready to receive the sounding skin. This is generally a sheepskin, which is stretched tightly across the head above and below, and fastened from the outside by hoops. These skins are all imported from Liverpool, and cost from $1.75 to $2.50 a dozen. Previous to using, they are stretched and dried by steam in the winter and by the sun in summer. Before being stretched over the drum barrels, they are once more moistened, generally in a solution of pure water or slightly ammoniacal. Then remains the tightening of the drum hoops. This is done either by strings or rods. The first are stretched diagonally, leather tighteners being inserted to stiffen the sound skins. The rods are hooked on one end and screwed at the other. Of this latter kind, the consumption is over six times that of the older fashioned.

Wooden drums differ but slightly from the above. The barrels are generally bass or white wood, occasionally oak. The stay hoops are of oak or beech. Before the strip of wood can be used, it needs to undergo many processes, among others being bending, planing, and sweating. The first drums made used to be boiled in open tanks, and the limit that could thus be prepared daily was less than fifty. The introduction of machinery and more perfect methods has increased the daily production, so that 2,000 drum pieces is considered nothing more than one man's fair day's work. The log, usually cut to three feet in length, is placed between the teeth of a huge machine, and the slicing begins. The knife receives it, and, as the log revolves, the piece sliced is received on a wooden cylinder and then rolled up. Seventy-five thicknesses make one inch of the log. If then the log is three feet through, one revolution will yield a piece nine feet long, and the total length sliced from the log would extend over a mile. Cutting machines further reduce this huge sheet to the desired lengths. A core of six inches thickness is left, which is taken out of the jaws and split into drumsticks or tenpins. The veneers are heated, then bent, and are soon ready to be shaped as a drum. There are also planing and sandpapering machines, all run by water power. The strips are put through the bender, from three to six at a time. The sticks are smoothed by rolling in revolving barrels, the process being continued for three or four hours.

Experimental Yellow Fever.

Dr. Carlos Finlay, of Havana, has published the results of several experiments he has made on the inoculability of yellow fever. He performed the operation, or rather got it performed for him by mosquitoes, which he caused first to sting a patient suffering from yellow fever and shortly afterward a healthy person who was to be (with his own consent of course) the subject of the experiment. He found that the disease was only inoculable from the third to the sixth day. When two mosquitoes were employed, so that a double dose was given, the symptoms of the experimental disease were somewhat more severe than when only a single mosquito was used. Of eleven cases of inoculation, six were efficacious, one doubtful, and four negative. The period of incubation varied from five to fourteen days; the symptoms consisted of headache, pyrexia, injection, with sometimes an icteric tint of the conjunctiva, and in some cases albuminuria. The fever lasted, as in the ordinary form, from five to twenty-one days. The author believes that this method of producing artificial yellow fever will ultimately be found very valuable as a prophylactic against the natural and dangerous form of the disease.—*Lancet.*

ACCORDING to the *American Railroader*, it costs a little more than 20 cents a mile to run a locomotive, on the average. Nearly 8 cents of this is for fuel, 7¼ for pay of engineer and fireman, ½ cent for oil and waste, and more than 4½ cents for repairs. A ton of coal will run a locomotive twenty-four miles, a pint of oil will run eleven miles, and a pound of waste one hundred and twenty-three miles. The locomotives of a railway like the Northwestern run a half million of miles a month.

The National Defense.

The Select Commission on Ordnance and Gunnery, appointed by Congress July 6, 1884, has been taking testimony at different manufacturing points in the United States, and has now presented its final report to the House. The testimony thus gathered shows that there cannot to-day be made in the United States a steel gun above eight inch caliber, but that various companies are willing to undertake the operations of casting, forging, rough boring, rough turning, and tempering the parts necessary to make guns of the largest caliber, provided sufficient remuneration be offered.

The principal iron companies which appeared before the commission differed widely in their opinion of what the proper remuneration should be. While some of them required contracts for a long term of years, others were content with five. The required output varied from one to two thousand tons annually to five, six, and even ten thousand tons, according to the caliber, as the risks of manufacture increase directly with the bore. The figures furnished by the Cambria and Midvale companies were about $800 per ton. At this rate, the annual amount of the contracts would reach as much as eight millions. With their previous experience in this direction, the Midvale Company refused absolutely to furnish even an estimate of what they would require to be guaranteed to make them undertake the manufacture of guns exceeding twelve inch caliber. In the case of 16 inch guns, the risks at first would be enormous. It is the general opinion of both the commission and private concerns that works which would undertake the smaller sizes would in time be able to produce the largest required, but experience and education will be necessary before the work can be done at anything like a reasonable price. The commission, however, is unanimous in recommending that all guns for use by the army and navy, including those for fortifications, shall be constructed in the United States.

The question then arises as to where, and by whom, the guns shall be made. The report of the Gun Foundry Board shows that the cost of a complete plant for casting, forging, rough boring, rough turning, and tempering parts of guns up to 100 tons would be about $560,000, exclusive of buildings. It would seem, therefore, in view of the immense contracts wanted by private firms, that there must be a wide margin of profit to cover the risks, and that it would be advisable for the Government to establish a national establishment. If, however, the manufacture of the rough material for steel guns be given over to private enterprise, the commission favors the appointment of two firms, in order to guard against the inconvenience which might arise from the reverses to which any business undertaking is liable, and to profit by the closer attention to the details of manufacture, and the consequent greater perfection in the product, which would result from such a competition. In case the building up and furnishing of these guns is done by the Government in its own factory, the selection of the site for such a factory would have to be made with extreme care. It would have to be free from any danger of capture by hostile forces. It would have to be near the establishment furnishing the rough parts of the gun, and so located as to enjoy good transportation facilities both by rail and water, especially the latter, since the guns must be delivered at the proving ground, at Sandy Hook or Annapolis, before distribution to the fortifications. The commission does not seem to favor an interior location, on account of the difficulties of transportation. Where this is accomplished by railroad, due regard must be had to the strength of bridges, as such heavy freight is not common. Proximity to the centers of skilled labor and supplies, as well as the utilization of existing resources of the Government, must also be considered. The question still remains open as to whether the work shall be done wholly or in part by the Government. The commission appears to favor the partnership or combination system, by which private concerns act in conjunction with the Government.

The present capacity of the United States to produce armor is lower than its ability to furnish the requisite guns, since less attention has been given to the subject. The maximum thickness which could be produced to-day is twelve inches. No definite information could be obtained in regard to the cost of armor, though a number of firms expressed their willingness to undertake its manufacture, if the compensation were made sufficient.

The question of marine engines was more readily disposed of, for the present equipment of the navy yards at Boston, New York, Washington, and Norfolk would enable them, with slight addition of more modern tools, to produce all that is required. The testimony taken demonstrated the ability of American workshops to build engines equal in every respect to those made in foreign establishments.

The commission also reports favorably on our advance in naval architecture. Iron and steel war vessels can now be built at several of the navy yards in this country and in private establishments already in operation. If any great number were required at short notice, it would be necessary to resort to both the national and private ship yards. It was decided that the most favorable site for the construction of these vessels is on the Delaware River. No difficulty would be experienced in increasing the navy at once, for the necessary plant is already in existence, our iron masters possess the requisite knowledge and their workmen the needed skill.

Power Loom Silk Weaving.

Le Moniteur du Tissage Mecanique des Soieries gives the items of expense for power loom weaving, so that any intending manufacturer may be able to know at once what these are, and by comparing the probable expense for weaving, according to the goods produced, and adding thereto the permanent expenses and the wages to be paid for drawing in and warping and the discount to be allowed to customers, he is able to find exactly what the goods would cost him. The following is the calculation:

	Francs.
Net price of a mill, driven by a turbine, of 200 power looms, at 2,000 francs per loom	400,000
Interest and depreciation of this capital at 12 per cent	48,000
4 tacklers	6,000
2 warehousemen	4,000
2 boys	2,000
1 carpenter and 1 smith	3,000
1 lodgekeeper	1,000
Expenses and dues of water	5,000
Horse and cart	1,500
Cartage	4,000
Insurance	1,000
Taxes	2,500
Lighting	3,000
Heating	2,000
Repairs of looms, healds, reeds, strapping, shuttles, cards, etc., at 100 francs per loom	20,000
Repairs of the building	5,000
Oil, dusters, etc	1,000
4 overlookers	4,000
Traveling expenses	1,000
Dining room and wash house for the workpeople (heating, etc.)	3,000
	517,000

This sum divided between the 200 looms, working 250 days per year, gives us a result of 2·34 frs. per loom per day for a mill driven by water power. For a mill working by steam power, we must add 0·15 fr. per loom per day, making the total into 2·49 frs. A manufacturer starting a mill of 200 looms driven by water power must therefore be prepared to meet expenses amounting to 2·34 frs. per loom per day before calculating any profit on his production.

Introduction of Railways.

The following are the dates of the introduction of railways in the various countries from 1825 to 1860:

England	September 27, 1825
Austria	September 30, 1828
France	October 1, 1828
United States	December 28, 1829
Belgium	May 3, 1835
Germany	December 7, 1835
Island of Cuba	In the year 1837
Russia	April 4, 1838
Italy	September, 1839
Switzerland	July 15, 1844
Jamaica	November 21, 1845
Spain	October 24, 1848
Canada	May, 1850
Mexico	In the year 1850
Peru	In the year 1850
Sweden	In the year 1851
Chili	January, 1852
East Indies	April 18, 1853
Norway	July, 1853
Portugal	In the year 1854
Brazil	April 30, 1854
Victoria	September 14, 1854
Colombia	January 28, 1855
New South Wales	September 25, 1855
Egypt	January, 1856
Middle Australia	April 21, 1856
Natal	June 26, 1860
Turkey	October 4, 1860

Lighthouse Illumination.

At the Society of Arts, on March 10, a lecture was delivered by Mr. E. Price Edwards "On the Lighthouse Illumination Experiments at South Foreland." The general results of these experiments were that while electric arc light was more absorbed in proportion than gas or oil light as it passed through fog, still its greater intensity enabled it to penetrate much further than these. The Berlin core carbons of Messrs. Siemens were found to operate best, the core being of graphite. The conclusion derived from the experiments was that for ordinary purposes of lighthouse illumination mineral oil is best, and that for salient headlands, and very powerful lights, electricity is best. A six-wick mineral oil lamp burning six hours consumes four gallons of oil at 6d., that is to say, 3s., including cylinders, etc., whereas a 108 jet gas burner for the same period of lighting would cost 10s. for coal alone, since it would consume 1,800 cubic feet of gas.

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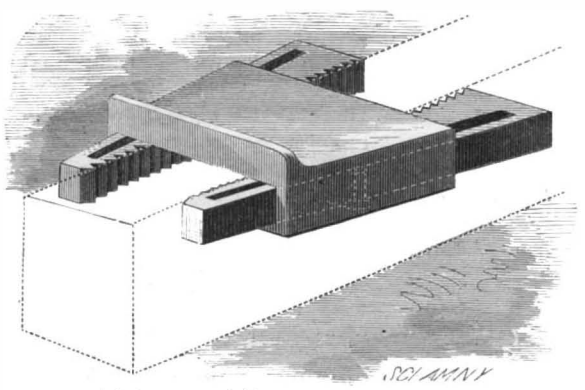
MECHANICS' KEYING CLAMP.

This keying clamp is designed more particularly for carpenters' use, for furnishing an abutment on joist, studding, or other timber, and its principal use is in connection with wedges for forcing together flooring or ceiling. The frame is formed with diagonal side flanges, and is constructed to receive and hold jaws against the flanges, so that when the jaws are moved longitudinally they will approach and recede from the center of the tool, according to the direction in which they are moved. The jaws are wedge shaped and serrated on their inner edges, and each is formed with a slot. They are held in the frame by the inwardly projecting flanges and screws that pass through openings



ABERNETHY'S MECHANICS' KEYING CLAMP.

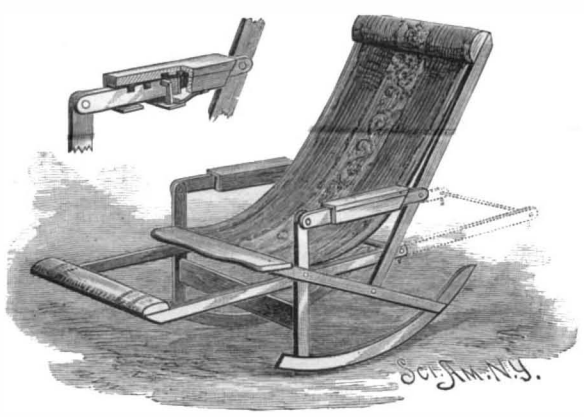
in the flanges and enter the slots. At the narrow end of the frame is a projecting lip, to furnish a broad surface to wedge a fulcrum against, according to the use to which the tool is put.

When used on joists, it is placed astride the timber, and the keys are moved forward until their serrated edges come in contact with the timber, when they will hold the tool in place, so that any pressure on the narrow end of the frame will cause it to slide down the jaws, thereby making them grasp the timber firmly, so that the tool will sustain any pressure brought to bear upon it without displacement.

This invention has been patented by Mr. Robert S. Abernethy, of Rutherford College, Burke Co., N. C., who will furnish any further particulars.

RECLINING ROCKING CHAIR.

The inclination of the seat of this reclining rocking chair can be readily changed without the inconvenience of leaving the chair. The rockers, front standards, and the diagonal braces, carrying at their forward ends the seat board, are united by screws or bolts. The head board is carried by two strips pivotally connected with the brace bar by bolts. The arms consist of box-like structures, formed of side pieces united by a top strip. A short strip secured in the rear part of the groove between the sides projects so as to be pivotally connected with the back bars. The forward ends of the arms are supported by bars pivoted to the standards and sliding in the arms. These bars are guided by plates secured to the under side of the forward part of the arms; and by means of a catch entering notches in the upper sides of the bars, the latter can be moved outward or inward as required, to change the position of the chair. The small view clearly shows the construction of the arm. The canvas or carpet strip constituting the body of the seat and back is tacked to two strips which are fastened to the seat and



COEN'S RECLINING ROCKING CHAIR.

head boards by screws. A rectangular frame, upon one end of which is a foot rest, is arranged so that it may be pulled forward or shoved in as shown by the full and dotted lines.

This invention has been patented by Mr. George W. Coen, of Monticello, Ind.

ONE of our most sensible contemporaries says: "If it is a possible thing, the SCIENTIFIC AMERICAN improves with each issue. It is the most interesting and instructive scientific publication printed."

The Cultivation of Licorice.

Consul Woodcock, of Catania, Sicily, says that there are two species of the licorice plant in his consular district. The one sends down a main root to the depth of from three to six feet, with but few lateral roots; the other does not sink so deep in the earth, but creeps beneath the surface at a depth of from six inches to two feet, the latter being most productive, and the most highly prized. It is stated that if the licorice plant were cultivated, instead of being allowed to grow wild, it would yield much larger results; but the Sicilians are of opinion that its culture will not pay, so they are satisfied by collecting it as produced by nature in its wild state. No use is made of the stem except for fuel. The licorice plant grows most luxuriantly in the valleys adjacent to streams of water; it is, however, found among the foot hills of the mountains, but grows less luxuriantly there. It requires a moist soil, consisting of a clay loam; the climate must be warm, such as is adapted to the growth of oranges, lemons, and other semi-tropical fruits. It cannot endure frosts, or cold, high altitudes. The root continues to grow for four or five years, when it is considered in the best condition for gathering. The root will continue to grow for ten or twelve years longer, but it is not considered so rich in juice-yielding quality. The crop is gathered from the same ground once in four or five years, and on the average 100 pounds of the root produces 16 pounds of licorice paste.

During the months of June, July, August, and September, and the first part of October, the root is not disturbed, for the reason that it is then in full vegetation, and for the further more important reason that the ground is dry and baked by the sun, and it is with much difficulty and great expense that it can then be dug. As soon as the autumn rains set in in sufficient quantity to saturate the ground, the root harvest commences. During the months above mentioned the manufactories of licorice are idle, doing little or nothing in the way of manufacture. In Catania itself there are seven manufactories of licorice, which employ from twenty to forty hands each. When the roots are taken from the earth, they are bound in bundles and carried on the backs of mules from the fields to the factories, where they are laid by for a time to season. When the roots are sufficiently cured, men and women with hatchets cut them in pieces ranging from three to six inches in length. These are then plunged into a vat of water and thoroughly washed. They are then crushed in a mill of rude construction. It consists of two circular stones of lava, one in horizontal position, and the other, which is perpendicular, resting upon it. Through the center of the upper stone is an axle, to which is attached a mule, which revolves it slowly in a circle upon the lower stone. A workman with a wooden shovel is constantly employed in keeping the roots beneath the revolving stone. When the roots are sufficiently crushed, they are placed with water in kettles and boiled for twenty-four hours. They are then removed from the kettles and placed beneath a screw press, and all the juice, which is thoroughly pressed out, runs into a cistern beneath. This juice is pumped from the cistern and passed through a sieve into kettles and the boiling resumed. The sediment from the strainer is again pressed; the contents of the boiling kettles are a second time filtered. When boiled to the proper consistency, it is removed to a broad shallow kettle over a slow fire, where workmen, with spades, continue to stir it until it becomes dense enough for paste; it is then removed and placed in wooden moulds of the size they wish the cakes, or worked by the workmen into little rolls or sticks. When cold and hard, the cakes are wrapped in paper and boxes for export. The little rolls or sticks of licorice are placed upon shelves to dry, and when they become perfectly dry and hard, they are packed in laurel leaves in boxes. In preparing the root for market, women, with knives, scrape off the bark, and then cut it into pieces of about half an inch in length, or as desired by the purchaser. These are then dried in the sun, and placed in bags for export.

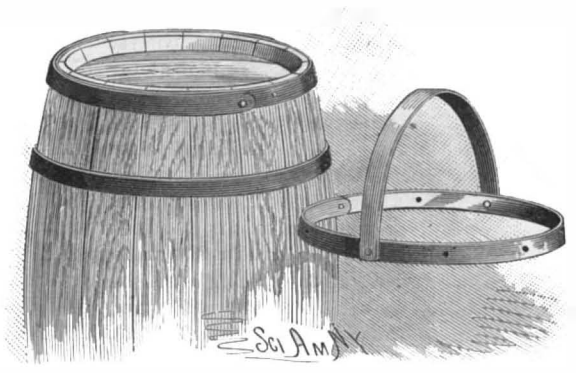
Casting of a Great Gun.

The fourth attempt to cast the last of the large breech-loading rifle cannon for the Government, by the South Boston Iron Works, was made on the 5th, and was entirely successful. It was witnessed by a number of prominent military men, including Lieutenant Borup of the army and Lieutenant-Commander Lyon of the navy. Several weeks had been spent in preparing for this casting. Three large furnaces were used, each containing about thirty-five tons of metal. The fires were started at nine o'clock on the previous evening, and the casting made shortly after noon. The gun pit had been prepared with the greatest care; the core, which hung down in the middle of it, was one of the stoutest and best ever made. At the end of about twenty-two minutes, the metal had filled the pit, and the rough shape of the last of the 54-ton rifle cannon was completed.

The gun is now cooling, and in several weeks the core will be removed and the gun taken from the pit. When the present one is finished, the four large guns cast at these works will each be 12 inch bore, and will measure 30 feet in length. The powder charge will be 265 pounds; the weight of projectile, 800 pounds; the muzzle velocity, 1,860 feet per second; the muzzle energy, 19,000 tons; the pressure per square inch of bore, 15 tons; and the penetration of iron plate, 23 inches.

CONVERTIBLE KEG.

The keg is of the ordinary form and is hooped in the usual manner, except at the head end, where it is provided with a hoop having a bail hinged to it. The length of the bail is such that it can only fall to the level of and rest against the middle or lower portion of the hoop when folded down. When the hoop is applied to the keg, the bail may be folded to one side, when it will

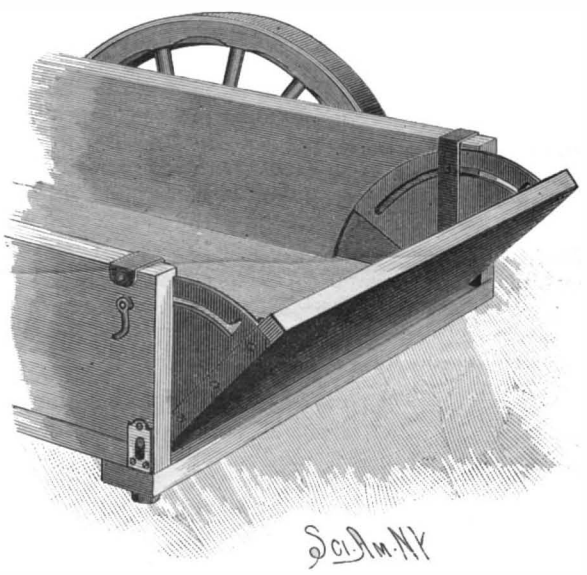


SCHEEL'S CONVERTIBLE KEG.

lie in line with the hoop, the keg then presenting the usual appearance, as though without a bail. After the head has been removed and the hoop secured by rivets, the keg may be used as a bucket or pail. By the use of this device—which is the invention of Mr. John H. Scheel, of 5 Front Street, New York city—the small butter and other packages which are now destroyed after the contents have been removed may be made to serve useful purposes.

END GATE FOR WAGONS.

To the opposite ends of the gate are secured plates, preferably made of cast iron, which are sector shaped and which fit into recesses formed in the inner surfaces of the side boards. The angle formed by the straight sides of the plates is a little greater than 90°, so that when the gate is let down into a horizontal position the edge of the plates will overlap the sides of the box, thereby completing the sides to the end of the gate. A curved slot is formed in each plate, and at the end of each slot is a lateral notch. A bolt passes through each slot, through the side boards and through strap bolts which are bent over the tops of the side boards and extended down to support a cleat extending across the under surface of the rear end of the box, and which supports the bottom. The bottom is the thickness of the gate shorter than the sides, and the cleat thus forms a rabbet in which the edge of the gate rests when the latter is lowered. The sides, near the bottom of their rear ends, are provided with slots for receiving the pivots of the gate. When the gate is closed, the bolt enters the notch, the lower edge of the gate drops into the rabbet, and the pivots rest in the bottom of



NOYES & GARDNER'S END GATE FOR WAGONS.

the slot. Upon being tightened, the bolts draw the side boards together. To let down the gate, the bolts are loosened, and the gate is raised to bring the pivots into the upper ends of the slots, when the gate may be lowered to a horizontal position, the inner end resting on the cleat and the outer end being supported by the bolts in the curved slots. When lowered, the plates form side pieces, which prevent the escape of the contents of the box over the ends of the end board.

This invention has been patented by Messrs. A. H. Noyes and E. S. Gardner, of Jefferson, Wis.

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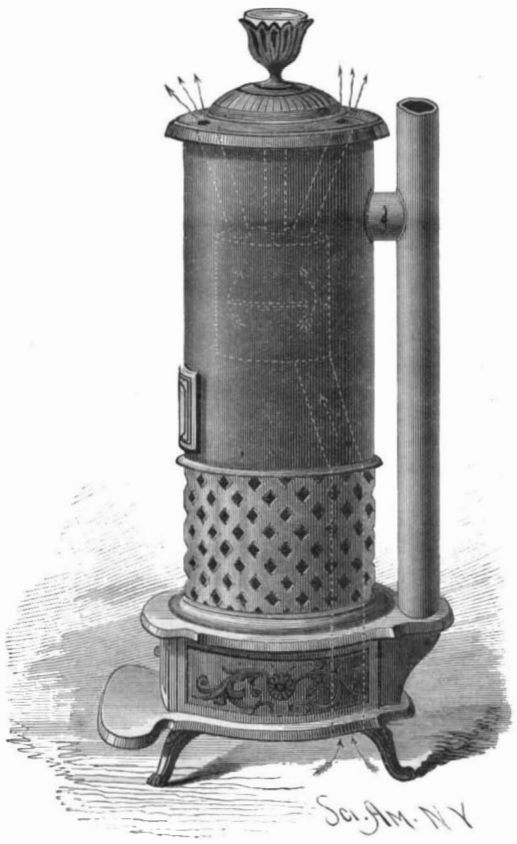
IMPROVED HEATING STOVE.

The accompanying engraving shows a stove which has been recently patented by Mr. George A. Taylor, of New Hampton, Ia. The exterior does not differ in appearance from stoves in every day use, but in the interior are certain cold and hot air flues (represented by the dotted lines) which, it is claimed, add at least twenty-five per cent to the heating capacity without increasing the consumption of fuel. This arrangement does not increase the size of the stove nor detract in any way from the outer heating surface, but is so placed within the stove that air drawn in at the base is brought in direct contact with the heated fire pot, from which it passes directly above the fire, where it is brought, if possible, to a still higher temperature before it again passes into the room through the pipes in the upper part of the stove. The fire pot is made of cast iron, which is a much better radiator of heat than brick, and which also allows the fuel to drop evenly when shaken, as coal does not burn on this as on other material. Surrounding the pot is an open lattice work, which adds much to the appearance of the stove, while allowing the free passage of air to its outer surface. Any additional information can be obtained by addressing the inventor.

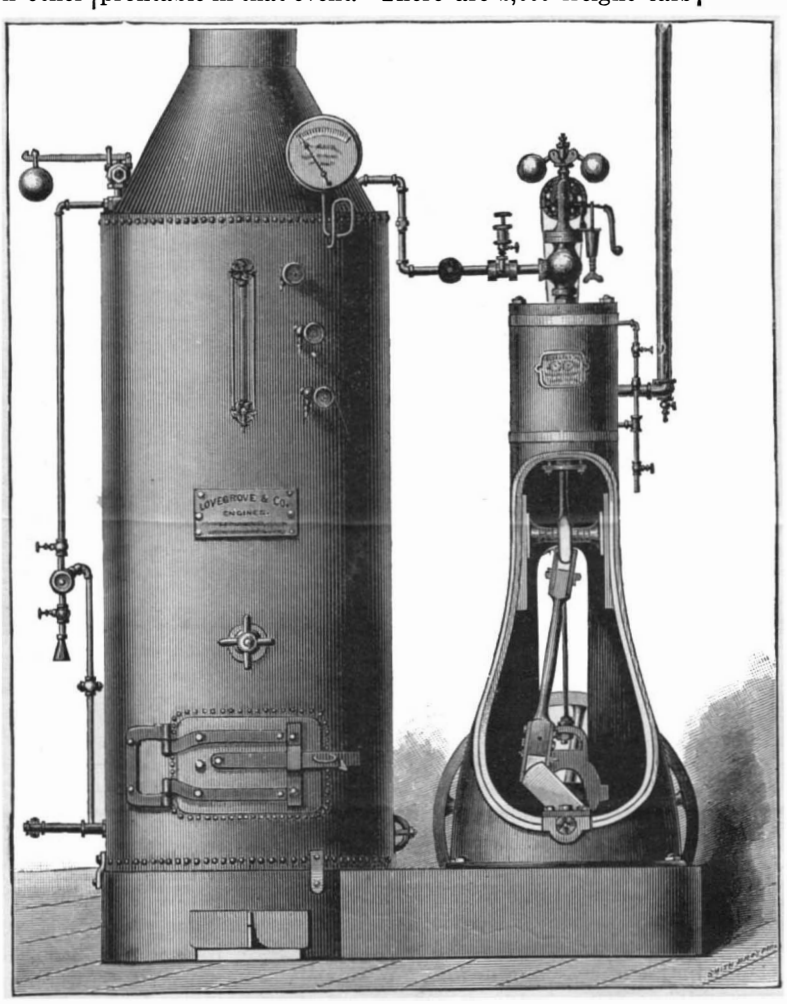


TAYLOR'S IMPROVED HEATING STOVE.

AN ENGINE AND BOILER FOR GOOD SERVICE.

The accompanying illustration shows a combination of engine and boiler especially worthy of the attention of steam users desiring moderate powers, the plant for which shall occupy but a small space. The boilers are made of the best wrought iron, vertical seam, double riveted, and are tested to 200 pounds before they leave the shop. The fire box is stayed in the best manner, and there are hand holes for cleaning the water legs and crown sheet. The engine is easily accessible in all its parts for adjustment and repairs, the valve connection being straight, with no offset to wear or get out of line and cause extra friction; while the wearing surfaces of guides for crosshead, crank, and wrist pin are large, and each provided with means for taking up the wear. The shaft is of best hammered wrought iron, and has large bearings. The piston is fitted with springs and rings, and all the parts are made of sufficient strength to enable the engine to fully develop its rated powers. The engine frames are very heavy, and the boilers are amply large to develop steam for the engine at its full power. For fifteen horse power the floor space occupied by engine and boiler is only 4×6 feet.

These engines and boilers are made by Messrs. Lovegrove & Co., 152 North Third Street, Philadelphia, Pa.



THE LOVEGROVE COMBINED ENGINE AND BOILER.

BESSEMER steel is made in the United States equal to that made in England.

A Trade Mark Decision.

The case of Rogers *et al. vs.* Rogers *et al.*, decided by the Supreme Court of Errors of Connecticut, arose upon a suit for an injunction to prevent the use of an alleged trade mark. The plaintiffs, manufacturers of silver plated ware, used the words "Rogers & Bro., A1," as their trade mark, and they claimed that the use of the words "C. Rogers & Bro., A1," by the defendants constituted an infringement thereof. The court, affirming the decision of the court below, denied the injunction, on the ground that the defendants' use of their own name was fair and honest and in the ordinary course of business. The court said: "We think there is neither authority nor reason in support of the doctrine that the fair and honest use of one's name can be enjoined, when it is used in the ordinary course of business, in the way and manner in which other manufacturers of similar goods are accustomed to use their own names in the preparation for the sale of goods.

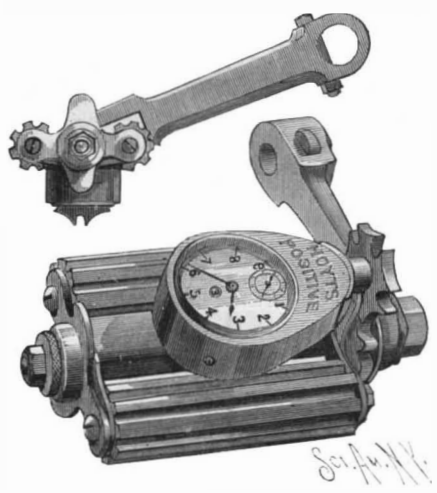
Such a rule would operate in restraint of trade, and prohibit a person from using the ordinary means which all are entitled to in the prosecution of business enterprises. Such a use contains no element of false representation or personation in any just and true sense, and while it may be true that a possibility exists that the goods of one will be purchased to some extent by persons who know no distinction, or by the few who suppose them to be the goods of the other, this condition of things is inevitable in trade and commerce, inhering in the nature of things, and attaches in kind, if not in degree, in all cases where a manufacturer sends goods of any particular description, but without distinguishing mark, into a district of country where such goods were before unknown, and establishing a reputation there as the manufacturer and vender of such goods."

Encouraging Prospect for the City of New York.

The *Railway Herald* predicts that the construction of the Croton aqueduct will open the way to something new in the railway business of New York. We expect within ten years to see our city honeycombed underneath by railroad lines. The drilling for the aqueduct has shown men what can be done in that line. One of these days men will go over into Jersey and dig down until they reach a level a hundred feet below the bottom of the North River. Then they will drill right through under New York, and the next thing we know all the railroad depots will be in the heart of the city. When that time comes, there will be branch lines running up and down under the city for freight. The merchant, instead of sending his goods down to the dock, will take them to the nearest shaft, where an elevator will lower them to the cars on the track below. It is probable that such a tunnel would be put right through under the East River also. It would be immensely profitable in that event. There are 2,000 freight cars daily sent around New York by the various roads, which are bound through east or west. It costs these roads now over $5 a car to get these trains around the city. On that basis, the tunnels could start with a business of $10,000 a day.

A POSITIVE CYCLOMETER.

The cyclometer shown in the accompanying engraving possesses many novel and new features. It is rigidly secured to the under side of the pedal, and its weight alone keeps the pedal right side up whenever the foot of the rider is removed, which of course is very seldom. When the rider's foot is upon the pedal, the cyclometer is held firmly in place, while it receives its motion from the revolution of the crank pin in the pedal, which, at every revolution of the wheel, must make a revolution of the pedal. The mode of connection is by means of a "Geneva movement," whereby all parts of the recording mechanism are securely locked, yet without the least friction, except when the cog of the finger wheel is in operation. The internal recording parts are very simple, and are run by the use of worm and worm wheel, thereby securing a positive movement without the use of ratchets, springs, pawls, or levers of any kind. There is no chance for a miss or slip, and every revolution of the wheel is properly recorded, whether it goes backward or forward. It can be connected or disconnected in a few moments, and the record can be read from the saddle with a little practice and care.



HOYT'S POSITIVE CYCLOMETER.

The cyclometer is the invention of Mr. G. P. B. Hoyt, of 202 Lewis Street, New York city, who may be addressed for any further particulars.

Sub-Aqueous Photography.

Photography under curious and novel circumstances has recently been attempted at the Forth Bridge, where several groups have been taken in the working chamber of one of the caissons under a pressure of air of 25 pounds to the square inch. It was found that this did not have any effect upon the film, but that the passage of the rays of light was very greatly interfered with by the haze or fog which is always found in compressed air. In order to get a sharp image, it was necessary that the air-compressing machine should be run slowly and steadily during the experiments, and that the locks which afford entrance and exit for men and materials should be kept closed, as variations of pressure, either upward or downward, increased the haze. The photographs were taken by Mr. E. G. Carey, assistant engineer, who brought very considerable perseverance to the work. He obtained the light in the first instance from three and afterward from five arc lamps of 1,200 candle power each, and to judge of the time of exposure, he first took a group on shore under similar conditions of illumination. Ten seconds were found to give fair results, and a series of views in the caisson were taken with 12, 20, 25, and 30 seconds' exposure. These proved, on development, to be greatly under-exposed, and ten days later a second attempt, under similar conditions, was made, but with exposures of 5, 10, and 15 minutes. The plates were, however, poor, indistinct, and blurred, and it was evident that more light was required. Five lamps were then tried, one at either side of the group, one behind it, and two lighting the remainder of the chamber. This attempt gave encouraging results, with 7 and 8 minutes' exposure. In the final experiments it was decided to try the effects of plates of exceptional rapidity, similar to those used for the most rapid yacht work, and these, with an exposure of 1½ to 2 minutes, gave very fair results, the lamps being in two rows, one at either side of the group, in such a position that they could not shine into the lens. The lens used was by Dallmeyer, 2½ inches aperture and 18 inches focal length, the plates being 12 inches by 15 inches. We have received copies of the groups, and find, in spite of the difficulties, that the faces come out very clearly, particularly when it is remembered how long was the exposure.

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How to Improve Roads.

Henry County, O., has been well nigh ruined by mud. With lethargy born of a sense of despairing helplessness, the people have submitted to their heavy burdens. Year after year the mud blockade has almost stopped the wheels of business for periods of weeks at a time, amounting in all to nearly one-fourth of the year. Everybody prays for good roads, but nobody puts his shoulder to the wheel. Our roads can be very materially improved at an expense entirely within the means of even this tax-burdened people. By all means let us have stone roads as soon as possible; but first let us prepare a place to put the stone, to insure us against the chance of losing it in mud unfathomable. For the sake of illustrating, let us suppose that we are going to make an entirely new road. After the road is located we will stake out the track, which should not be more than 20 feet wide. After this is done, let a competent and trustworthy civil engineer stake out two lines for tile drain, each a few feet from the center line of the roadbed. Then tiles should be laid to a perfect grade, not less than an average depth of three feet, and carried to the nearest outlet, no matter what the distance nor what the expense. This is an absolute necessity, as without efficient tile drainage there can be no good road built in Henry County, either of stone, gravel, or any other material that is accessible. After the tiles are laid as above directed, proceed to raise the roadbed about 15 inches in the center and 8 or 9 at the outside, by scraping upon it the surface soil. No clay should be allowed on the road. It should then be made perfectly even and smooth. No hillocks or hollows should be allowed under any circumstances. It will then be a good plan to go over it several times with the heaviest rollers and make it as compact as possible. Then dig your side ditches with the same care as to grade and outlet as was done with the tiles. These open ditches need not be deep, but should be so graded that no water will stand in them to soak and soften the bed of the road. They will carry off the water that falls upon the road, while the tiles will carry that which comes up from below.

In order to keep this road in good condition, appoint a man to go over it every day in the wet season, and draw off the water from puddles that may form on the bed of the road and fill them up, and also to keep the side ditches in good working order. The road should be completed as early as the middle of August, so that it may be well settled before the fall rains set in. Let the above principles apply to old roads. The roadbed need not be raised more than two feet above the general level, unless in crossing a low place.

After you have constructed your road in the above manner, you have a foundation upon which you may build your stone or gravel road, which you may delay doing until you feel able to bear the expense. When you wish to put stone on the road, make it twelve inches thick at the center and six or eight at the side; the width should be from twelve to fifteen feet. This done, you have a road that will be a pleasure to travel on at any time of the year. Farmers can then sell their produce when the price is most satisfactory.

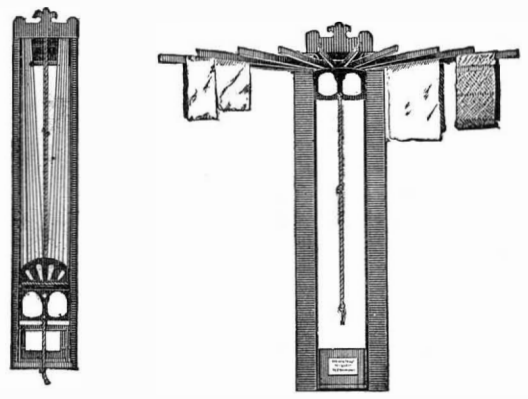
There are three prime essentials to road building in this locality. They are: first, drainage; second, better drainage; and third, the best drainage possible.—*T. C. H., in Napoleon, Ohio, Signal.*

Protection of Vineyards from Frost.

The damage which may be done in vineyards by frosts in spring is so serious that in some French districts great care is taken to light fires as soon as the temperature falls dangerously near to freezing point, and to create clouds of smoke over the vineyard to prevent radiation as much as possible. In one district of France, a telegraph inspector, Lestelle, has introduced an ingenious arrangement for rendering this smoke protection automatic, and applying it as speedily as possible in moments of danger. In the center of the vineyard he places a mercurial thermometer. When this falls to 2 deg. above freezing point, the mercury closes the circuit of a small galvanic battery. This sets in motion a commutator worked by clockwork, which sends the current from a small Ruhmkorff inductor through several circuits of wire in succession. Corresponding to each of these circuits is a heap of suitable combustibles laid ready, and an ignition apparatus, which is fired by the current. These heaps of fuel are placed some forty meters apart, and are of course so composed that their ignition is certain, and that they will smoulder and give off a maximum of smoke. With this apparatus the costs and the unreliability of night watchmen in early spring are done away with, and also the delay attendant on lighting the fires. If a sudden frost comes on, the whole vineyard is enveloped in a few seconds in a cloud of smoke. The cost of the apparatus is given as about $10 per acre, for which space three fires are necessary to insure perfect protection.

AUTOMATIC CLOTHES DRIER.

When closed, the clothes drier here shown takes up no more room than a picture on the wall; and when opened and full of clothes, the rods are raised to the ceiling, so that no more floor space is occupied than if no clothes were drying. The drier consists of a light wooden frame, 4 feet long, 8 inches wide, and 2 inches deep. Inside of the frame, close to the sides, are two ¼ inch round steel rods, sliding on which is a piece of malleable iron, carrying a box or chamber for holding the ends of the bars. When not in use,



NEW AUTOMATIC CLOTHES DRIER.

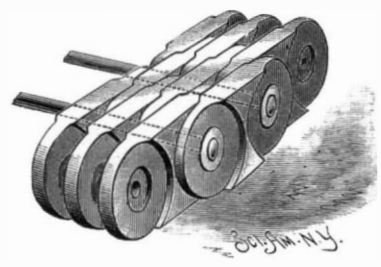
the whole ten arms and chambers can be folded inside of the frame. The arms are each 3 feet long, thus giving thirty feet of line.

The drier has suitably arranged cords and weights, which raise the arms and clothes to the ceiling, and by means of a hand rope the clothes can be pulled down when wanted, or the clothes may be raised and lowered by operating a cord fastened to the sliding frame and then passed over a pulley in the head of the main frame.

Further particulars can be had from the patentees and manufacturers, Messrs. Deverell & Co., of Rouseville, Pa.

LEATHER-LINK MACHINERY BELT.

The principal object of the invention herewith illustrated is to increase the strength and durability of the belt without diminishing its area of contact or frictional surface with the pulleys. The leather links are of the usual elliptical form, and have holes in them to receive the metal rods on which they are placed. The links are solidified at their ends by compression, which reduces the thickness, as shown. The side edges at the center are left the full thickness of the leather, so the surface of the links that comes in contact with the pulleys will be as great as possible, thus tending to prevent all danger of the belt slipping. In some cases, in compressing the ends of the links, there will be formed countersinks on one or both sides about the holes, as shown in the cut, to receive metal washers placed upon the rods between the links. Triangular portions are left uncompressed at the transverse center of the links,



BABCOCK'S LEATHER-LINK MACHINERY BELT.

so that, owing to the loose texture of the leather in an unsolidified state, the links will have a slight central edgewise elasticity, which will relieve the belt of rigidity and the individual links from strain at the ends when passing around the pulleys. The rods are headed at both ends, to retain the links in close contact with each other.

This belt is manufactured by the American Leather-Link Belt Company, of 78 Cliff Street, New York city, and is the invention of the superintendent of that company, Mr. H. C. Babcock.

Echoes at Sea.

The echo fog signal devised by Mr. Frank Della Torre, of Baltimore, has been tested at Fort Carroll, by order of the Navy Department. This apparatus consists of a single barrel breech-loading rifle, provided with a large funnel or speaking trumpet on the muzzle, a box of cartridges, and a tripod. The first experiment was made from a tug, at a distance of half a mile from the fort. With the discharge of the rifle, a distinct echo was heard by those on board the tug, without the use of any receiving apparatus other than the unassisted ear.

When a boat intervened between the tug and the fort, two echoes were heard, the fainter one coming from the vessel. In favorable weather, the echo has been heard four miles. The steam whistle of the tug was also tried, but gave less distinct echoes than the sharp report of a rifle. A passing steamer, about a mile from the tug, gave a very distinct echo. Mr. Della Torre's signal was intended primarily to prevent collisions with icebergs in heavy weather, when it was impossible to be aware of their presence except by means of an echo, but is equally applicable in advising a ship's officer of the neighborhood of another vessel or other obstruction to navigation.

Mr. Bell, it will be remembered, has interested himself in this method of signaling, and believes strongly in its practicability. The navy officers who made the experiments at Fort Carroll will report favorably on the invention, and advise further experimentation. It is suggested that an officer be detailed to try this method of collecting sound on board a United States man of war, so as to test the effect of different states of the weather, and ascertain precisely the range of usefulness possessed by the invention.

Development of the Human Body.

During the International Medical Conference held at Copenhagen, the Rev. Malling Hansen, Principal of the Danish Institution for the Deaf and Dumb, presented a paper which attracted considerable interest. It gave the daily results of weighing and measuring the 130 pupils (72 boys and 58 girls) of the institution during a period of three years. The facts demonstrated by these statistics were quite a surprise to the medical people in attendance. Since this preliminary notice, given in the summer of 1884, Mr. Hansen has continued his observations, and now believes himself able to furnish some outline of bodily development. Each child was weighed four times a day—in the morning, before dinner, after dinner, and in the evening; and was measured once. These daily records show that, contrary to general opinion, the increase in weight and height of the human body during the years of growth does not progress evenly throughout the year. Three distinct periods were observed, and smaller variations were noticeable within these divisions. In bulk, the period of maximum increase extends from August to December. A period of equipoise then succeeds until the middle of April, and the following minimum period completes the year. The lasting increase in weight occurs during the first period; the period of equipoise adds about one-fourth of that increase, but this is almost entirely spent during the last period.

The increase in height shows a similar division into periods, but in a reverse order. In September and October, a child grows only a fifth of what it did in June and July. Thus in the autumn and early winter a child increases in weight, while the height remains stationary. In the early summer, on the contrary, the weight changes but little, while the vital force and nourishment are directed toward an increase in height. This periodicity in the development of the body marks a strong similarity to plant development, and it is quite probable that further investigations would show another likeness in the fact that these results are good only for the latitude in which they were obtained. In a climate less variable than that of Denmark, it is highly probable that the periods would be less marked, and in an even temperature would cease to be distinguishable.

An Exhibition of Barometers.

The Royal Meteorological Society lately held an exhibition of barometers. A paper was read by the president, Mr. Ellis, of Greenwich Observatory, in which the history of the barometer from the time of Torricelli, in 1643, to the present day was treated. The exhibits consisted of specimens of nearly every kind of instrument which has been invented, from the merest glass tube filled with mercury and inverted in a cistern of mercury to diagrams of the King's self-registering barometer and the photographic registering barometer, parts of the (Jordan's) glycerine barometer, and the numerous self-recording barographs and aneroids which have been brought out during the past few years. The best of all such contrivances is the photographic instrument employed at the leading observatories, in which friction is altogether avoided and traces of great clearness and accuracy are obtained. Then there are the mechanical instruments of M. Redier, of Paris, remarkably accurate, and of exceedingly beautiful make, which give a continuous trace of great delicacy. Then, too, there is the admirable self-registering aneroid of M. Richard, in which the effect of friction is obviated by a multiplicity of vacuum chambers. The records of this instrument when carefully made are exceedingly good, and the instrument is relatively very cheap. Of standard, marine, and other barometers there was an abundant supply, and it was interesting to see how the contrivances of 200 years ago for enlarging the scale of the barometrical range are still being reproduced in the ordinary wheel barometer. In addition to the above there was a collection of new instruments of various kinds, in which various nephoscopes and a self-recording thermometer by M. Richard were conspicuous. The exhibition was held, by the permission of the Institute of Civil Engineers, at 25 Great George Street, and was well attended.

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THE GEOLOGICAL HALL OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

(*Continued from first page.*)

The next cases display to us the varied and prolific life of the different Silurian groups. Here are brought to view the lavish multiplication of species, and the new re-enforcements of animal life extend its domain in all the orders of the invertebrate kingdom. So luxurious and manifold was the development of certain shell-incased organisms known as brachiopods, that the Silurian age has been comprehensively designated as the age of brachiopods. These animals possessed the seas and littoral borders of the continents of those days; since then their decline has reduced them to a few species.

Brachiopods were creatures grouped under the mollusca, along with oysters, mussels, and cockles, which secreted a calcareous shell around themselves made up of two valves joining along a hinge line, in some cases interlocked or articulated, in others freely moving over each other with the hinge line reduced or absent, and holding within their fleshy bodies two spiral processes, which were more or less extensible, and which were once thought to be feet, whence the descriptive name of brachiopod, from *βραχιων*, an arm, and *πους*, a foot, or arm-footed animals. These delicately constructed and finely fimbriated parts served as breathing organs, and were connected with the processes of feeding. The abundance of these animals in the Silurian age exceeds all imagination. Look at these slabs of rock packed closely with the embedded shells, while in the numerous trays the clean, beautifully ornamented species of *Spirifer*, *Strophomena*, *Rhynchonella*, etc., are exhibited, reproducing that ancient fauna with startling distinctness. But associated with these multitudinous remains of brachiopods are many other forms even more interesting, and only less important from their restricted development.

Here are nests of quaint trilobites grouped together in numbers as they were buried upon the old sea bottom, some, as it were, arrested in their flexuous motion over the inequalities of the beach, and others preserved as they wrapped themselves, in some spasmodic movement of death, head and tail together, in cylindrical bundles. Here are corals torn by the hammer from stony bosses which were once the reefs of palæozoic seas, while long "straight horns"—the shelly incasements of extinct devil fish—plants, sponges, and exquisite stone lilies fill other shelves. Here are slabs of sandstone from an ancient seashore pitted with small shells from which lines and tiny ridges sweep, as though just drawn by a retreating wave, photographs in quartz of the gentle action of the primal tides, teaching the lesson of the uniformity of nature, when to-day we see the same surfaces on any ocean-washed shore.

We rapidly pass by some splendid examples of petrified casts of seaweeds, we take a few hasty glances at the beautiful chain corals, the delicate embroidery of bryozoan remains, animals belonging to the "sea mosses" of present seas, of which our common *flustra*, so frequently mistaken for a seaweed, is a good example, and then pass into the Devonian age, or the age of fishes. In it we encounter the fossils of those great extinct inhabitants of the ocean which have long formed some of the most interesting relics of ancient life. The fishes of those days were incased in bony plates whose articulating edges united them in an armor of durability and strength, and we can fancy their dark forms shooting through the marine depths like pelagic monitors. In the Devonian age an enlargement of the coral life occurred and the cup-shaped corals abounded. These are long or short cornucopiæ formed shells, generally single stems, but frequently grouped in colonies, and displaying upon their upper surface intricate networks of vertical, concentric, and transverse partitions.

The next cases introduce us to the Lower Carboniferous, or the age preparatory to the deposits of our coal beds. The most notable specimens of this period are found among the crinoids, whose sculptured calyces resemble toy boxes from which extend arms tressed with fringes of fimbriæ like a tassel. On our plate two are shown of different species, entrapped together, as they became interlocked and were buried at the bottom of seas rolling over the present site of Crawfordsville, Ind. These crinoids, briefly described, were inverted star fishes provided with a long, flexible stem made up of separate plates, rooting in the mud bottom and swinging to and fro, gathering their nutriment by means of the moving ciliæ along their arms. In this period these singular creatures flourished in enormous numbers, but have since declined, and are now represented by barely more than fifty species. Here also we meet corals, and brachiopods now waning in the dawn of new conditions.

We next enter the domain of the coal measures. Here the vegetable kingdom in its lavish expansion of forms overshadows everything else. Mighty tree ferns, gigantic club mosses, forests of tall sigillaria, and calamites shaded the warm estuarine borders and interiors of the continent. Their embedded fragments and parts have made our coal seams, while the land, through continuous oscillations, now rose and now sank below the sea level, and successive sedimentations sealed in the plant beds, whose slow change into coal has yielded our age the source of its mechanical and industrial progress.

We now pass through the Mesozoic and Tertiary cycles, encountering more and more familiar shapes in the shell remains and the increasing indications of mammalian life, until in the Quaternary we find the implements of those early men who crowned the works of creation by ushering in that period which some writers have designated as the psychic age, or age of mind.

The survey of this geological and paleontological cabinet has been very brief. It would be possible to linger many hours over the mineral cabinet, or exhaust our admiration over the cases of sea shells. The collection of fossils is unique. It was the famous Hall collection, accumulated during the survey of the State, of which Agassiz said, "Whoever gets Hall's collections gets the geological museum of America;" and it has been placed under the charge of one who is more familiar with it than its original owner, and through whose hands every specimen in it has passed. New additions have been made to it, and as it grows the student and the casual visitor will find new material for examination and pleasurable inspection.

Reclaiming Lands in Florida.

The Disston Land and Improvement Company is doing some marvelous work in Florida, in redeeming thousands of acres of land which are now under water. Already immense tracts have been thus made available, and it has been demonstrated that there is no better land in the State than that thus reclaimed. The company operates under a law of the State which allows it one-half of the land rendered available, and expects to reap a rich harvest before it finishes the improvements contemplated. The South Florida Railroad, from Sanford to Tampa, crosses the State on a dividing ridge, and from this ridge, looking south, there is a continual, but gradual, depression in the land to the southern extremity of the State. The land to the south of this ridge is different from that on its north, in that it is not at all undulating, but spreads out in a vast plain, gradually inclined toward the north. The Disston Company is utilizing this work of nature. Lake Kissimmee is in the midst of a series of lakes, and its northern point just touches the South Florida Railroad at Kissimmee City. This lake is a very long and narrow one, reaching toward Lake Okeechobee, with which it has been connected by canaling the intervening series of lakes. The lakes around Kissimmee have been connected to it by canals, giving a continual outlet to Okeechobee. Thus the areas of these lakes are lessened by the immense flow which finds its way to Okeechobee and from thence to the Gulf on one side, and to the Atlantic on the other, canals reaching from the immense lake to these two great bodies of water on each side. By this canaling process the level of Lake Kissimmee has been lowered six feet and that of the lakes surrounding it proportionately. In this manner the Disston Company proposes to reclaim thousands of acres of land, one-half of which will go to the State, and the other half to the company. The land which is thus made useful is not only that immediately surrounding these lakes, but extends in many places over miles of swampy bottoms. Since these lakes have been connected, it is now an easy matter to start by boat in Lake Kissimmee, in the center of lower Florida, and proceed by water through Lake Okeechobee to either the Atlantic or the Gulf. It is said that Georgia's great swamp, the Okefinokee, can be easily reclaimed. This immense morass, forming a distinct basin much lower than the surrounding country, is, at its lowest point, within but a few miles of the St. Mary's River, the level of which is below that of the swamp. These two connected by canal, the great Okefinokee is drained, and a magnificent area of land is ready for the plow. It is only a question of time.—*Atlanta (Ga.) Constitution.*

Legal Fog.

It was of a case in the United States District Court at Albany, many years ago. A patent right suit was brought on before Judge Nelson. William H. Seward was counsel on one side. In summing up he occupied a whole day. Peter Cagger came in while he was talking, and after listening an hour turned to a learned lawyer and inquired: "What is 'Bill' Seward talking about?" The counsel on the other side made a long speech, and the judge charged the jury. After the jury had been out about two hours, they came in court and the foreman said: "Your Honor, the jury would like to ask a question." "You can proceed." "Well, your Honor, we would like to know what this suit is about?"—*N. J. Law Journal.*

FOR a cheap preparation to dip wrought iron articles in to prevent rusting (after being milled), use hot soda water to clean from oil, then hot lime water, and dry.

Correspondence.

A Cow with Five Legs.

To the Editor of the Scientific American:

This creature was about two years old, and not higher than three feet. Her fifth leg was on her left shoulder, about a foot long, and looked like the other legs, except that it was cloven into three toes instead of two. The hoofs of this fifth foot were very long, as the animal could not use the leg. The other parts of the cow were perfect, and she seemed to enjoy good health.

The owner was an Armenian peasant near this town, who has brought it here, thinking that he would be able to get some money by exhibiting the animal.

A. G. SEKLEMIAN.

Ezroom, Armenia, Turkey, February 23, 1886.

How Far Light Penetrates Deep Sea Depths.

To the Editor of the Scientific American:

This subject, referred to by one of your correspondents in your issue of March 20, has been carefully investigated by Messrs. Fol and Sarosin, of the Society of Physics and Natural History of Geneva, Switzerland. Without giving all the details, it was found that light penetrated fresh water (Lake Geneva) sufficiently to affect very sensitive photographic plates at depths of 170 meters (558 feet), and at that depth "the light, at mid-day, was about as strong as that of a clear moonless night." Similar experiments carried on in the Mediterranean led to the following conclusions: "In the month of March, in the middle of the day and in bright sunlight, the last glimmer of light comes at 400 meters (1,300 feet) below the surface." A full report of these investigations appeared in the *Photographic Times* of July 10 and October 9, 1885.

G. C. HODGES.

Utica, N. Y., March 22, 1886.

Collision at Sea.

To the Editor of the Scientific American:

The late sinking of the magnificent ocean steamship Oregon, and the ill-fated vessel that collided with her, again brings to public notice that dreadful disaster, collision at sea. In most cases, the difficulty has been that neither navigator knew exactly what course the other intended taking.

Now, one will notice, the large majority of collisions occur between steamers and sailing vessels at night, and in most cases the sailing vessel is in the wrong. The latter has the "right of way," and if it kept on its course, all would be well. But at night, on the water, positions and distances are very deceptive. The navigator of the sailing vessel sees the red, white, and green lights of a steamer; they become rapidly brighter, and he makes out the great, dark monster coming directly down upon him. He knows he has the right of way, but thinks if he keeps on a collision will be inevitable, so suddenly changes his course; perhaps at the same moment the wheelsman of the steamer is changing his, and the next instant that which both aimed to avert is brought about, and usually with dire results. If either had known just what the other intended doing, the vessel would have kept on her course, and the steamer have gotten out of her way. Now, what is needed is some rapid way of communicating between two approaching vessels, what course one, at least, intends to take, and not have to wait for a vessel going at the rate of twenty miles an hour to "hide one of her lights" before the other vessel can know she intends changing her course.

There is plenty of inventive genius in this country to invent a way to transmit such knowledge, if our inventors would turn their attention in this much needed and worthy direction. As the pilots on steamers can judge what direction a sailing vessel is coming better than the navigator of the latter can the steamer's intended course, I would suggest that all steamers carry an additional white headlight on their bow, furnished with movable red and green screens, that can be quickly drawn in front of the light (thereby changing the white to a red or green light) by wires running from the light to the pilot house.

The wheelsman of a steamer, seeing a sailing vessel near, can decide on which side he should pass; if to "starboard," he can quickly draw the green screen in front of the light, thereby notifying the sailing vessel that she is to pass to the "starboard" side; or if the wheelsman considers the "port" the proper side to pass, he could draw the red screen, then the navigator on the sailing vessel could quickly know on which side the steamer intended to pass.

Of course, this idea is but a suggestion; but if it causes thinking men to take hold of such an important subject as lessening one of the greatest perils of the deep, it will have done its work; and I know no better way of reaching such thinking minds than through the interesting and highly prized SCIENTIFIC AMERICAN.

E. REYNOLDS.

Upper Falls, Md., March 29, 1886.

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Encaustic Tiles.

Encaustic or inlaid tiles consist of three distinct parts—the body, the inlaid pattern, and the back. The body is composed of ordinary fireclay, similar to that used for the diaper tiles, and is worked up into a plastic mass, which is moulded in iron moulds under a screw press. These moulds have raised patterns, which produce an indented or *intaglio* pattern upon the surface of the tile. The tiles thus formed are allowed to become dry, and the indented pattern is filled up by pouring over the surface of the tile a thick milk or slip composed of the white clays of Dorset and Devon, so much used in making earthenware, to which is added some pigment if colored patterns are to be introduced. Sometimes, where polychromatic patterns are desired, different colored slips are used, and poured into the parts of the pattern intended for each.

When partially dry, the surface is scraped even, until the face of the original tile or buff colored clay makes its appearance, when the indented pattern alone will be filled with the finer stained clays. If the tile thus prepared were fired, the body would contract more than the pattern, and the tile would be bent, and perhaps the latter fractured. It is hence necessary to apply a coating of the same fireclay used for the pattern to the back, to counteract this difference of contractibility; and as this clay, when hard burned, would not adhere well to the cement employed in laying them down, the back is pierced by a number of holes by means of projections in the mould, into which the soft cement is able to penetrate and form a solid bond.

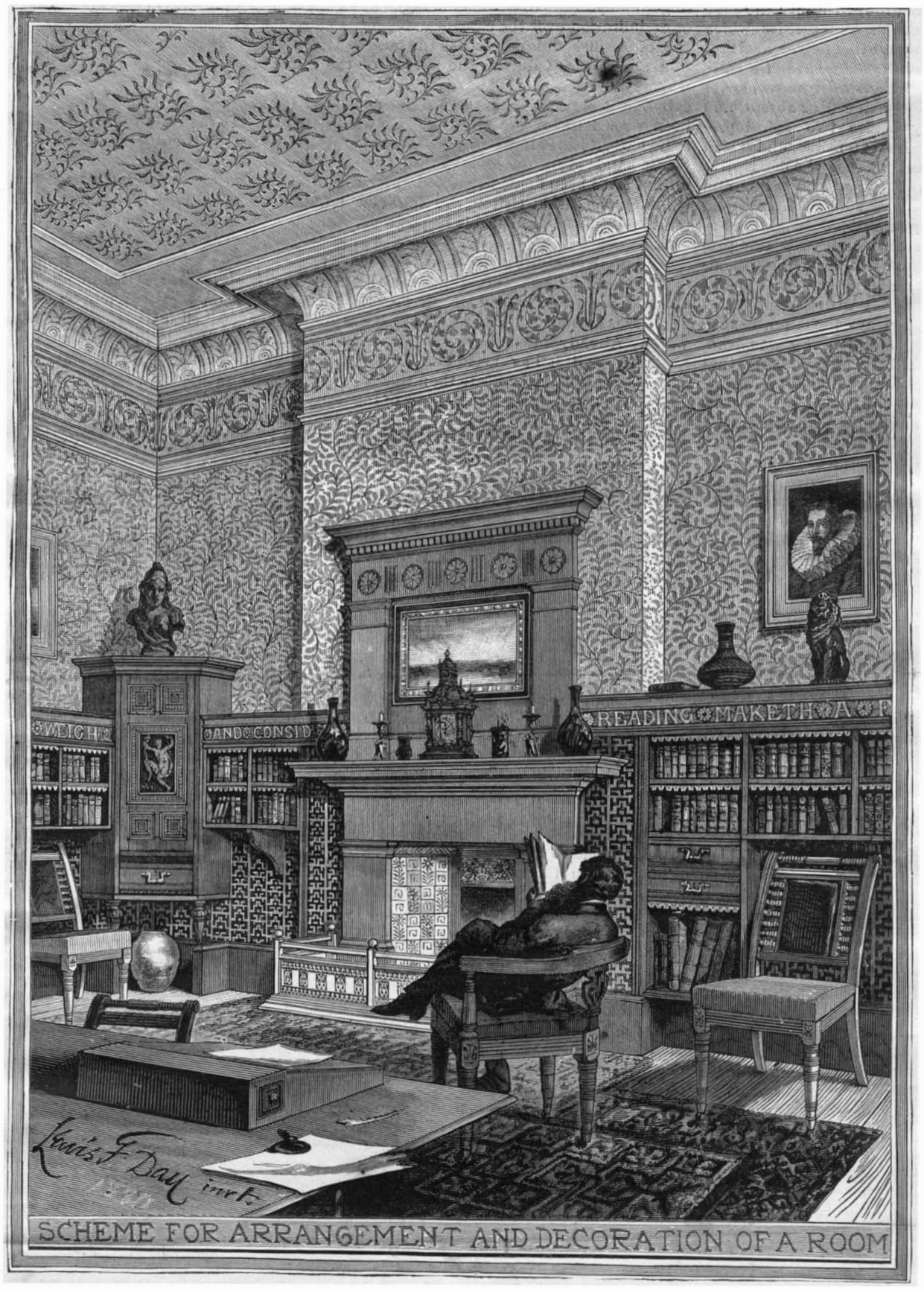
The Alhambra tiles are formed upon the same principle as the ordinary encaustic tiles, with this difference, that in the former fusible pigments are used instead of colored clay slips. This is the technical difference; but it must be confessed that there is a beauty of design and a harmony of color in the true Alhambra tiles which are still more characteristic of them, and which it is extremely difficult to equal. The majolica tiles are not so much distinguished by form as by the colored glazes with which they are covered; thus we may have indented or plain tesseræ covered with a monochrome glaze, or large tiles with foliated or arabesque indented patterns glazed, but not filled up, with different colored enamels. The great peculiarity of majolica colors is their softness and depth, which is the result of the soft enamel pigments employed. The Dutch tiles are true earthenware.—*Prof. Sullivan, in The Architect.*

Guthrie's Telephone.

A contribution to the telephone controversy comes from Leesburg, Ohio, where it is reported that Mr. J. T. Guthrie experimented on the transmission of speech by electricity long before Bell received his now famous telephone patent of 1876. It is stated that Mr. Guthrie has now perfected a new form of telephone quite different from any previous device. A patent has recently been granted to him for a telephone which is operated by a direct instead of an induced current of electricity, as in other telephones. This instrument is not affected by the weather. The intensity of the current is regulated by a turn of the key. It is cheap, and applicable to any telegraph wire. The ticking of a watch is distinct over a three mile circuit, and speech is stated to be possible over a distance of a thousand miles. It is shortly to be given an extended test.

FURNITURE AND DECORATIONS OF A LIBRARY.

Spring and summer are the seasons of the year usually selected for remodeling and decorating our dwellings, and it is believed that illustrations of the interior of houses which are decorated with taste and furnished in harmony with the painting will be acceptable to a great many of our readers. Our engraving this week represents a library, in which it will be observed that nice harmony prevails in the decorations, mantel piece, and furniture. The excellent illustration sets forth the room and its contents so clearly that any description that might be added would be superfluous.



Safety Devices for Rifle Ranges.

Experiments were lately made at Wormwood Scrubs with Mr. Morris' firing screens, which are designed to enable marksmen to practice even in populous neighborhoods. The invention is based upon the idea of stopping "wide" bullets soon after they leave the rifle; and this is accomplished by making the rifleman fire through an aperture in a small screen from a narrow platform inclined to suit men of different stature. Some twenty feet from this screen is a second, in which is an embrasure opening into a short gallery fitted with iron plates or curtains inside which stop the erring bullets. Beyond this is a third screen, with an aperture in it about six feet square, so that the marksman at the firing point looks through these screens, and sees very little except the target at which he is to shoot. The experiments proved successful.

Slate for Roofing and School Slates.

In Northampton County, Pa., in the neighborhood of Easton, the industry of cutting out slate for roofing, as well as the school slates which one becomes acquainted with so early in life, seems to be steadily growing; other quarries are also worked for this purpose in Vermont and on the Pacific slope, and suitable slates are likewise to be found in many parts of the country, but nowhere else has the industry shown such steady growth as in the section named.

The requisite kind of argillaceous or clay slate is found among the metamorphic rocks, passing into mica slate, and splits with ease into large smooth plates, of a uniform hardness, a dull luster, and in color a blackish gray, bluish black, bluish or reddish brown, purplish or greenish. When fresh from the quarry, it splits even more easily than pine timber. The slate is removed from the quarry in great blocks, which are landed on trucks and shoved along a track to shanties, where the splitters split them as if they were wood, and with far more accuracy. They are cut into sizes for roofing purposes with great expedition and dexterity. Those of fine quality are used for school slates. It is interesting to watch the work in one of the shanties. The splitter, with his mallet and broad steel chisel, sits on a block, and, taking a slab of slate between his legs, drives in his chisel a little way at one end. He moves it a little with firm, gentle pressure, and you can see the split begin to start as straight as a die. He repeats the operation at the other end. Then he drives his chisel in the middle and easily pries the slab in halves. The split pieces are split and split again until they are of the required thickness. As fast as they are split, a man who stands by the splitter takes the slates and runs them through the dressing machine. This is a cast iron form set on five legs, with a steel extension piece or arm about four feet long. Suspended over this is a steel knife, which is attached to a spiral steel spring and worked by the foot of the dresser. A gauge board guides his eye, and he puts his slate against it, presses his foot on the treadle, and down comes the knife, cutting the edge clean and straight. He makes the four edges straight and lays the slate in piles according to size. Just as fast as his foot can work, a good dresser keeps his machine going. The splitter and dresser work together, and are paid according to the quantity they turn out. Diamond saws are also used. They have a reciprocating motion, and make 140 strokes per minute. They cut only one way, however, and are lifted by a cam for the return stroke, a constant stream of water clearing the diamond teeth of the accumulated slate dust. The planers are similar to those used for planing iron, and the polishing bed is a disk of cast iron fourteen feet in diameter, making thirty revolutions per minute.

NOISELESS ANVILS.—If it is desirable to set up an anvil so that its use will make the least possible noise, set the anvil on a block of lead, or make a putty ledge around the anvil upon the wooden block, ½ in. clear all round, 1 in. high. Raise the anvil clear of the block ½ in., by any means available, pour in the lead until it rises above the bottom of the anvil; or set the anvil on a good bed of sand held in a box.

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MANUFACTURE OF GELATINO-BROMIDE DRY PLATES.

There are few travelers at present who have not become photographers; and so it is not surprising that the manufacture of photographic apparatus and products should have become very extensive. We have already given statistics concerning the manufacture of gelatino-bromide plates, showing that the annual amount of production in Europe is estimated at ten million dollars. A few data of an analogous character concerning sensitized paper will give further proof of the present extent of the trade in photographic materials.

The paper employed for forming images is manufactured almost entirely by one French house, which turns out 50,000 reams per annum. This paper is afterward covered with a layer of albumen, and is rendered sensitive. The paper thus prepared is worth, at the lowest figure, $100 per ream, and the value of the annual product amounts to $3,000,000. The other sensitized papers, such as gelatino-bromide of silver, carbon, etc., amount to $1,000,000. If to this we add the chemical products and the woodwork, we shall arrive at an annual total of $10,000,000.

It will be seen that the manufacture of dry plates itself forms half the total production of photographic materials. All professional and amateur photographers now use these. But are there many who know how they are made? We think not. For our part, wanting to know something about it, we applied for this purpose to one of our largest French manufacturers, Mr. D. Hutinet, who was good enough to show us all the details of his large factory on Parmentier Avenue, Paris.

It has seemed to us that it would be interesting to every one, and instructive to the profession, to know the mode of manufacture of the dry plates that they are constantly using, and this has decided us to write the present article.

Dry plates are plates of glass covered with an emulsion of gelatino-bromide of silver. The manufacture of them comprises a series of operations that we shall now pass in review.

1. *Preparation of the Emulsion.*—A large number of formulas have been published in special treatises, and one of the simplest of these is the following: Introduce into a wide-mouthed bottle: Distilled water, 300 cmc.; bromide of ammonium, 18 grammes; good gelatine, 12 grammes. (The operation being performed in a room into which light is admitted through ruby-red glass.)

After the gelatine has swollen, put the bottle into a water bath and raise the temperature to 40° C.

In another bottle dissolve 27 grammes of crystallized nitrate of silver in 150 cub. centimeters of distilled water. Pour the silver solution in a thin stream into the gelatine, and, at the same time, keep the latter constantly agitated by a circular motion, even after the two liquids are united in the same bottle. After this, put the bottle into a water bath and raise the temperature to the boiling point. Care must be taken to stir the emulsion with a long glass rod, and to continue the boiling for from fifteen to twenty minutes. After this, allow the temperature to fall about 35° or 40°, and add from 12 to 15 grammes of gelatine that has previously been swollen in a little distilled water.

After these successive operations, the emulsion must be poured into a basin and allowed to cool in darkness. After the jelly has set, it must be washed in order to free it from useless and injurious salts, and passed through a filter and collected in a piece of muslin stretched over a sieve. After having been washed for twenty minutes under a faucet, the emulsion must be put into a bottle into which is introduced a third proportion (say 12 or 15 grammes) of gelatine.

After the gelatine and emulsion have been rendered homogeneous, the latter is ready to be spread over the plates.

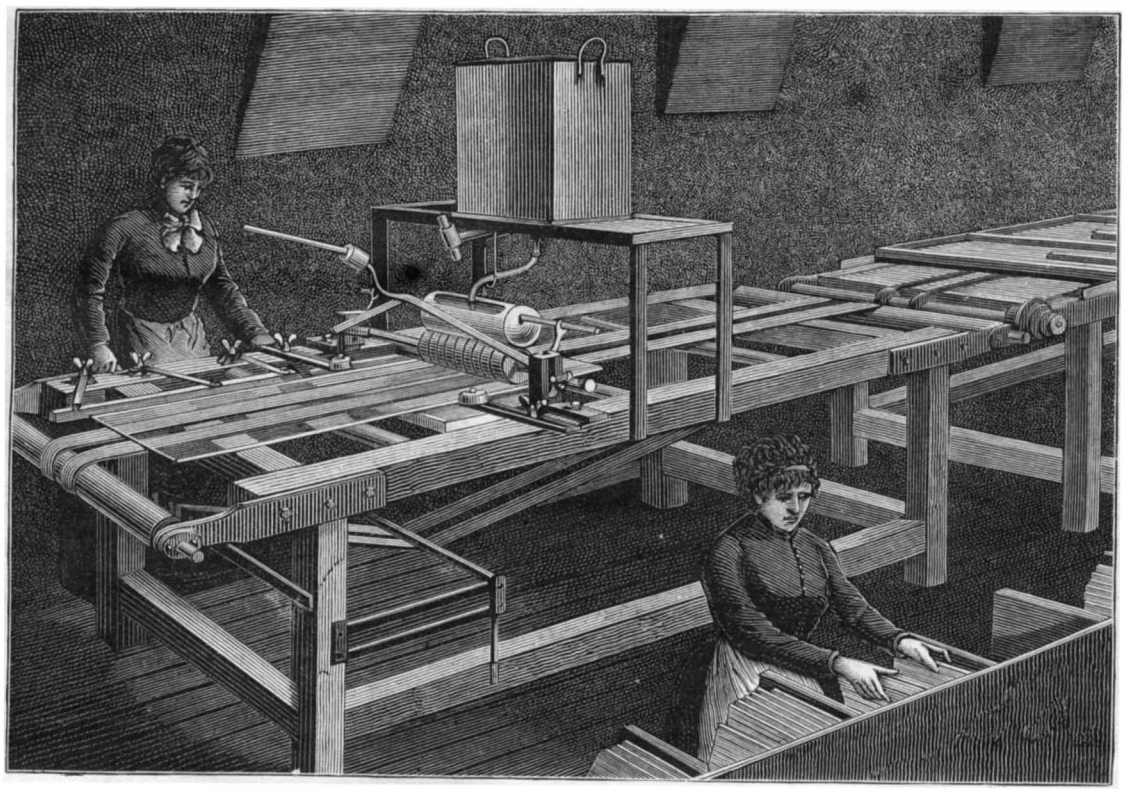

Fig. 1.—APPARATUS FOR COATING GELATINO-BROMIDE PLATES.

2. *Coating the Plates.*—When it is a question of manufacture on a large scale, the spreading of the emulsion over the plates offers very serious difficulties. The duration of the operation must be as short as possible, since the emulsion constantly changes state. Spreading by hand is always imperfect, on account of the inequality in thickness of the layer obtained.

The operation of spreading the emulsion is done mechanically at Mr. Hutinet's factory.

Our obliging guide was indispensable to us for visiting his factory, as alone we should not have dared to take a single step on account of the darkness that reigned therein. Upon entering the laboratory, we saw nothing but black walls and a few luminous red points, but as our eyes gradually got used to the darkness they saw numerous small lanterns with red glasses placed here and there. By and by we distinguished shadows; they were workmen at work.

Finally, after a quarter of an hour, our eyes got used to the darkness, and we went up to the room containing the machine that does the coating (Fig. 1). This room is sixty-five feet in length.

The glass, which has been previously cleaned, has exactly the width that it is to preserve when cut, and its length is 4 feet. Each strip is placed upon two endless belts, which are actuated by a steam engine.

The glass thus carried along passes under a roller, which presses very lightly against its surface, a counterpoise serving to balance it. The emulsion is contained in a vessel which is heated by a water-bath, and which is seen in the center of our figure. It flows out slowly, and in the desired quantity, through a glass cock, and falls into a vessel of the same length as the roller. This vessel contains small apertures in the bottom, through which the emulsion flows uniformly over the roller, which, in its rotary motion, covers the glass therewith. The strips of glass are placed one after another, and travel a distance of forty feet, and during this the emulsion hardens.

3. *Drying the Glass.*—At the end of the table the strips are taken up and placed in a drier (Fig. 2). This consists of wooden racks placed in a room which is heated as follows: The air from the outside is filtered through wadding, and is heated by steam pipes under the double floor of the drying room. From thence it ascends in the four corners of the room as far as to the ceiling, and is afterward distributed throughout every part. Under the racks at each side there are gratings that allow of the passage of air, which is sucked in through the draught of the 78 foot chimney of the factory. Thus the hot air, coming from above, becomes charged as it descends with the moisture produced by the drying of the glass. Owing to this arrangement, there is little or no dust.

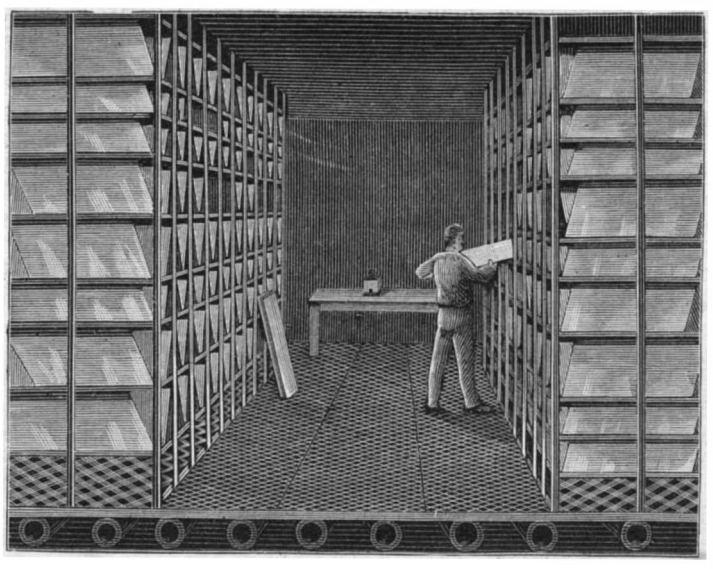

Fig. 2.—DRYING ROOM.

4. *Cutting the Plates.*—When dry, that is to say, six or eight hours after having been placed in the racks, the strips are taken to the cutting room. Each strip is divided into the proper number of plates by a very simple apparatus, maneuvered by a girl (Fig. 3).

This apparatus consists of two grooved pieces of wood, whose distance apart is regulated at will by nuts. As we have already said, the strip is cut to the proper width before it is coated. At the end of the table there is a board, against which the glass abuts. The distance between this and the ends of the wooden guides determines the size of the plates, which are cut by means of a diamond. During the cutting, the plates are examined one by one by other girls, and those that have any defects are thrown aside, while the others are gathered up and packed.

5. *Putting up in Packages.*—The packing apparatus (Fig. 4) consists of three parts. The lowermost of these extends beyond the level of the table, and carries six grooves, and sheets of fluted paper placed therein exactly fit into these latter. On each side of the bottom piece there are two vertical ones, which are movable and provided with grooves that correspond to those of the former. The plates are introduced, one by one, into these grooves, and fluted paper is placed on top. This done, the lower part, through a mechanical move-

Fig. 3.—CUTTING THE PLATES.

Fig. 4.—PACKING MACHINE.

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ment, descends beneath the level of the table, while the two vertical ones separate. The six plates are then pressed together by the girl, but are kept from touching one another by the folds of the paper. They are afterward put up in packages, and two of the latter are placed in one box. A strip of paper is pasted over the top of the boxes, and after this the latter can be taken into the light.

This entire manufacture requires great care and the use of various expedients. For example, Mr. Hutinet informs us that in order to counteract the effect of heat, during the coating of the plates in summer, he has been obliged to construct a small conduit for the strips of glass to slide under, and which is supplied by water at a temperature of 12° C., derived from a well that had to be bored to a depth of 40 meters (131 feet).—*La Nature.*

Proposed Increase of Postage Rates.

A bill introduced in the Senate by the Hon. James F. Wilson, of Iowa, and now pending in both branches of Congress, provides that the rate of postage on fourth-class matter shall forthwith be doubled. The present rate is sixteen cents a pound. By increasing it to thirty-two cents, the bill proposes to make it the same as letter postage.

Such an increase would be a serious hardship to thousands of people, who now depend upon the mails for receiving necessary supplies from a distance. It will be admitted that few goods out of the long list now sent by mail will permit a freight of thirty-two cents per pound. It does not seem fair to these people to allow the growth of their dependence upon the common carrier, and then make its services almost prohibitive on no better grounds than those offered.

A strong claim can properly be urged, as well, for those lines of business which have been built up under the existing rates, and which would be crippled to the point of extinction were the rates doubled.

As it is, postage on fourth-class matter is greater than in other countries. Canada, for instance, permits the sending of seeds, plants, and samples for four cents a pound. The United States postal service carries these goods *en route* from Eastern Canada to the Northwestern British Provinces at this rate, while our own citizens, for the same service, are charged four times as much; and it is now proposed to make it eight times.

There is, moreover, too great a discrepancy already between rates in the different classes. Though people are not disposed to complain at a letter postage of two cents an ounce, we hope in time to see it reduced to one cent. Newspapers and magazines pay but four cents a pound, as they are properly regarded as important civilizers, and therefore entitled to legislative discrimination. Third-class matter, such as books, photographs, proof sheets, etc., the printing on which (we quote from the official bulletin) "is designed to instruct, amuse, cultivate the mind or taste, or impart general information," passes the mail censor at eight cents a pound. The fourth-class is eminently utilitarian. It is supposed to possess none of the desirable qualities recited for the third, and in their absence pays double the rate. Americans are proverbially fond of amusement, and they are also proverbially practical. But why a funny photograph or a comic song should pass the mails at half the rate charged for such useful articles as mineral specimens, seeds, queen bees, or dress goods, does not appear.

The present proposition to further burden this class of mail matter is not, as one might suppose, an effort to increase the intellectuality of the mails by limiting their contents to the instructive or amusing, but is a movement presumably in favor of the express companies. The monopoly which they formerly enjoyed has not been forgotten. At the present rates, private carriers can compete with the mails successfully in handling local business; but in case of long distances, and particularly anything approaching transcontinental carriage, the mails have so far the advantage that they carry everything which comes within the prescribed limits of weight and harmlessness.

It is, of course, an open question as to how far the Government may properly bring itself into competition with private enterprise. Our own views on the subject are very broad. If the Government can deliver our letters and telegrams, and transport our person and goods, with greater dispatch and economy than a private corporation, we are quite content that it should do so, and would regard the action as a matter for congratulation, and not complaint.

The measure now before Congress is suggested ostensibly to meet the deficiency in the revenues of the Post Office Department. During the current fiscal year this will amount to about $10,500,000, and during the coming year it is calculated that it will not be less than $9,000,000. We do not dispute the desirability of making this department self-supporting, but it does seem unwise to throw the entire weight of the deficiency upon a class already charged out of all proportion to the rest. If an increased rate is absolutely necessary, it might be distributed among the classes. But we don't believe that such is the case. Each year sees such a marked increase in the business of the department that, with the existing rates, it may safely be assumed that the income will speedily equal the expenditure, and will even warrant a further reduction in the rates.

Gutta Percha.

The extraordinary progress that has been made in electrical science within the last few years, and the consequent large consumption of gutta percha as an insulating material, has naturally caused apprehension lest the supply, owing to the great demand for it, and to the carelessness of the natives who gather it in the forests of India, shall soon give out. This has recently led to much investigation concerning the nature of the product yielded by trees of other genera (such as *Mimusops*, *Payena*, *Siderocarpus*, and *Bassia*) belonging to the same natural order (Sapotaceæ) as the percha tree (*Isonandra Gutta*). Mr. Pierre, in No. 46 (1885) of the *Bulletin de la Société Linnéenne* of Paris, has given a long list of the Sapotaceæ which grow in Annam, and which yield a juice that might, when concrete, serve as a substitute for gutta percha; but the trouble seems to be either that the trees grow too isolatedly or that their places of growth is too inaccessible. Mr. Edward Heckel, in a note presented to the French Academy of Sciences on the 11th of May last, made known to that body the possibility of obtaining a coagulable latex, similar to that yielded by the *Isonandra Gutta*, from the karite tree, *Bassia Parkii;* and in an another note to the Academy on the 23d of November, he gives the results of an examination made by himself and Mr. F. Schlagdenhaufen of the physical properties of the new product, and of its chemical composition as compared with that of gutta percha. From these researches, it appears that the two products are approximately identical. The gutta from the *Bassia* kneads in warm water with the same facility as typical specimens of commercial gutta percha, and moulds made with it are in nowise inferior to those prepared from the best quality of the last named material. The future of the new gutta for industrial purposes would therefore appear to be certain. The karite tree is very abundant in Africa, and is distributed throughout the entire basin of the Nile —a portion of the country which has hitherto been unproductive, but which now offers a source of wealth that it needs but willing hands to develop. The *Bassia* has hitherto been known only from a fatty matter of the consistency of tallow yielded by its seeds. This product, called karite butter, is used by the natives of Africa for cooking purposes, for filling their rude lamps, for making soap, for healing wounds, and as a pomatum for the hair.

The Automatic Sprinkler.

One of those admirable reports issued on occasion by the Boston Manufacturers' Mutual Fire Insurance Company has just been published, containing an account of some new tests of automatic sprinklers of various sorts, made on behalf of the Mill Insurance Companies by Mr. C. J. H. Woodbury. Architects and builders are not so much interested as mill owners in the details of the tests of each particular kind of sprinkler, but the statistics of the service performed by sprinklers in general in protecting property from fire, which Mr. Woodbury gives, are very instructive. It is about ten years since the first automatic sprinklers were introduced into factory buildings, and mainly, we imagine, through the earnest advocacy of the mutual insurance officials, they soon came into general use in such structures. For other buildings, such, for instance, as theaters, they were at first regarded as unsuitable, perhaps on account of the danger of freezing, but this prejudice is now nearly abandoned, and all the new first class theaters in this country, we believe without exception, are equipped with a full sprinkler service over the stage.

There may, however, be still some persons who regard their use as an experiment, and to such persons the statistics given by Mr. Woodbury will appear particularly important. For mills, at least, there is no longer anything of experiment in the sprinkler service. Since 1876, when the apparatus was first introduced, there have been 224 fires in factories furnished with them, and insured in the New England companies, while 631 fires have occurred during the same period in mills without their protection. No one will claim that the number of examples of each sort is not sufficiently large to afford a satisfactory test of the comparative value of the two systems, but it is rather startling to find that the total loss by all fires for nine years in the mills furnished with automatic sprinklers was less than $86,000, an average of $382 for each fire, while the losses in the mills without sprinklers during the same period amounted to $4,645,000, an average of $7,361 for each fire.

This is more than nineteen times the average loss in the sprinklered buildings, so that it is fair to infer that if all the mills had been required to put in sprinklers at the time of their first introduction, the companies would have saved $4,400,000 in nine years. Dividing this by the number of unprotected mills in which fires occurred, we have a quotient of $7,000, and as it would not probably have cost more than $2,000 apiece, on an average, to put sprinklers in these mills, it follows that the mutual companies might have furnished these mills with sprinklers at their own expense, and would even then have made a profit on the transaction of $3,000,000 in nine years, with a prospect of future profits at a considerably larger rate for an indefinite period. In the present case, the mill owners being their own insurers, the result would practically have been that they would have taken a dollar out of one pocket and put four dollars into the other, but the story has a moral for the managers of stock as well as mutual companies.

As the account shows, however, some of the sprinklers used in the mills nominally so protected were inefficient, so that heavy losses occurred in spite of their feeble efforts, and we should, perhaps, make our comparison between the unprotected mills and those furnished with the Grinnell sprinklers, which have shown themselves in 102 fires to be, perhaps, the most effective of all. In these 102 fires, all of which have occurred since 1881, the average loss has been $112.76, or much less than one-third the average loss with all sorts of sprinklers, and about one sixty-sixth the average loss by fires in mills without any sprinklers. To repeat, therefore, our comments in another way, supposing the number of mills insured in the factory mutual companies to be 2,000, if the companies had, at their own expense, put in Grinnell sprinklers in all of them in 1876, at a cost of $4,000,000, they would already have got all their money back, with $635,000 additional as interest, and would be in the steady receipt of about $525,000 a year as income from their investment.—*Amer. Architect.*

Cornwall Tin.

Dolcoath is the name by which the oldest and the deepest tin mine in the world is known. It is situated at Camborne, in the west of Cornwall. In the early part of the present century it was noted for its enormous production of copper ore, the sales of this mineral having amounted to about £5,000,000. It now produces tin only. In the interval between copper and tin, about the years 1853–55, a period in the sinking when the two minerals were so blended that they could not be separated so as to make them marketable, the whole mine could have been purchased for £3,000. The market value of the same to-day is £470,000 (4,700 shares at £100 each); so that each sum of £50 invested in it thirty years ago is now worth £7,000, and receives dividends every twelve weeks amounting to about £500 a year! The produce for some two or three years past has been forty to fifty tons of tin per week, obtained chiefly from only one of the eight or ten lodes in the mine. About 1,400 hands are employed, representing, perhaps, a thousand families; but within the last month a discovery has been made which will not only largely increase the profits—now over £100 per day —but will at once furnish employment for nearly a hundred additional workers, and before long some hundreds of families will be supported by work done on this newly opened lode of tin.

The value of the discovery is greatly enhanced by the fact that it has been made at a depth of nearly half a mile below the surface, by a cross cut from old workings at the very bottom of the mine, and the new lode is as rich as the old—so rich that any piece of ground measuring only eight yards square (cubic yards) contains more than £5,000 worth of tin, and, so far as can be judged, this marvelous deposit of mineral will be absolutely inexhaustible for generations yet to come.

These metalliferous lodes, or veins, run from east to west, and may be traced for one or two miles. The discovery is in the eastern part of the mine. Two other shafts to the westward are being sunk, and in the course of about two years, if the work is pressed on, they both may be expected to reach the depth at which this most extraordinary deposit of mineral is found, and so lay open further immense stores of tin.

In the adjoining property, still a little further west, and near the Dolcoath boundary, is yet another shaft, which has actually struck the run of tin ground which yields the Dolcoath riches.

A Model Catalogue.

One of the most practical and convenient of catalogues is the April edition of the Pope Manufacturing Company's, of Boston, New York, and Chicago, in which are illustrated and described nine Columbia bicycles and tricycles. The book is of fifty-two pages, and contains fifty-one illustrations, the mechanical drawings of the several machines, parts, and sundries being remarkable in mechanical clearness. The Columbia machines for the season of 1886 have undergone much improvement over those of past seasons, and the company has put upon the market this season five new machines, namely, a safety bicycle, a semi-roadster, a racing bicycle, a ladies' two track tricycle, and a racing tricycle. The catalogue will be sent free upon application.

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PYGMY CATTLE.

The extraordinary pygmy cattle of Benares and other parts of India, a specimen of which, about the size of a month old calf, has for some time been on exhibition at Central Park, are the result of careful selection continued for many generations, and are very fair representatives of the result of heredity. A cow of the same diminutive variety was for years an attraction to visitors at Prospect Park, Brooklyn.

The disposition of these small cattle, as indicated by their expression, is extremely mild and gentle. In their own country they are, as indicated by their name, worshiped by the natives as incarnations of the Holy Spirit and as containing the soul of some future Buddha. Treated with the greatest consideration and never subject to the vicissitudes that the Bos genus is subject to in Christian countries, they may rather be said to own their keepers, who are their servants, and who would consider it a greater crime to harm one of them than to kill a human being. Ramsay Wright considers the humpback cattle of India possible descendants of the gayal or gam, the wild cattle of Bengal and the peninsula generally. The method of catching and domesticating these cattle by the Kookies of the Chittagong hill districts is as follows:

A number of balls, each about a foot in diameter, composed of salt, cotton, and a particular kind of earth, are first made up and scattered about a part of the jungles frequented by the animals. A number of tame cattle are then driven to these places, where they await the coming of the wild ones. The two herds mingle, the opposite sexes associating together. As they graze, the balls, attracting attention by their shape and smell, are tasted, and relishing the taste of the salt and the earth of which they are composed, the combined herd of tame and wild cattle never quit the spot until all the balls are consumed.

"The Kookies," says Mr. Macrae, from whom this account is quoted, "having once observed the gayals to have tasted the balls, prepare a sufficient supply of them to answer the purpose, and as the gayals lick them up they throw down more. It is to prevent them from being too readily consumed that the cotton is mixed with the earth and salt. This process generally goes on for three changes of the moon, or for a month and a half, during which time the tame and wild cattle are always together, licking the decoy balls; and the Kookie, after the first day or two of the mingling of the herds, makes his appearance at a distance, so as not to alarm the wild ones. By degrees he approaches nearer and nearer, and at length the sight of him has become so familiar that he can advance to stroke the tame cattle on the back without frightening the wild ones. He next extends his hand to the latter and caresses them also, at the same time giving them plenty of decoy balls to lick. Thus in the short space of time mentioned he is able to drive them along with the tame ones to his "parrah," or native village, without the least exertion of force; and so attached do these captives become to the parrah that, when the Kookies migrate from one place to another, they always find it necessary to set fire to the huts they are about to abandon, lest the gayal should return to them from their new pasture grounds.

The small variety shown in our illustration is sometimes kept as a garden pet in our own country.

PYGMY OXEN AT THE CENTRAL PARK, NEW YORK.

The Air of the Sea.

The air of the sea, taken at a great distance from land, or even on the shore and in ports when the wind blows from the open, is in an almost perfect state of purity. Near continents the land winds drive before them an atmosphere always impure, but at 100 kilometers from the coasts this impurity has disappeared. The sea rapidly purifies the pestilential atmosphere of continents; hence every expanse of water of a certain breadth becomes an absolute obstacle to the propagation of epidemics. Marine atmospheres driven upon land purify sensibly the air of the regions which they traverse; this purification can be recognized as far as Paris.

The sea is the tomb of moulds and of aerial schizophytes.—*MM. Moreau and Miquel.*

Fish Killed by Poisonous Water.

Large shoals of dead fish have been met with between Egmont Key Light and Charlotte Harbor, off the mainland, and vessels have been several hours in passing through them. A few weeks ago the fishing schooner City of Havana, Captain John Curry, lost two loads of live fish, which were killed in sailing through strips of this poisoned water. It is said to be of a reddish color, and distinguishable for some distance from the surrounding water. Captain Samuel Morgan, a patient in the hospital, informs me that in some of the fresh water creeks fish are caught by placing bags of the bruised bark of the swamp dogwood (*Cornus sericea*) in still water, and that the fish will revive if allowed to remain in it for a short time only. There would appear to be some connection in this, as the mortality seems to appear after considerable rainfall in the swamps and fresh water outlets, and is not due, as has been stated, to submarine volcanic action. I have mentioned the fact to Dr. Joseph Y. Porter, U. S. A., and requested him to take advantage of his proposed visit to Tampa, Fla., this week, to collect samples of the water, should the vessel pass through any of these reddish colored strips.—*A. H. Glennan, Bulletin Fish Com.*

Pigments under Natural and Artificial Light.

M. Petrouschewsky has communicated to the *Journal* of the Russian Physico-Chemical Society an account of some experiments undertaken by himself for the purpose of ascertaining what mixtures of colors will give in sunlight the same effect upon the eye that is produced by various known colors as viewed by artificial light. A special form of photometer was used in these experiments, in which one-half of the field of vision is occupied by the piece of colored paper illuminated by the artificial light, while the other half is taken up by a card placed upon the table and exposed to daylight. Upon the surface of this card the colors are mixed until the general effect equals the tint of the other, and the two halves of the screen appear of the same color. Thus, to give to white paper the appearance which it has under the rays of a petroleum lamp, it is necessary to color it orange, or yellowish orange if the petroleum light is very bright. Papers colored reddish orange and vermilion become so intense in lamplight that it is impossible to imitate them by means of oil colors. Violet pigments take the aspect of reddish brown, not in the least resembling the true color. The mixtures of pigments thus obtained, looked at apart from the light of the sun, are very far from producing to the eye the same sensations as with the light of a lamp. In fact, the sensitiveness of the eye for various colors of the spectrum changes when this organ is accustomed to the yellowish light of petroleum, and the effect of the contrast with orange, which under this condition is taken for white, is an additional cause of error of judgment. By modifying his apparatus, the author has been able to continue his experiments under the electric arc light, which appears yellow in comparison with the light of the sun, and not bluish, as is generally thought.

Our Native Birds.

We are glad to see that the movement for the protection of American birds, recently started by the Ornithologists' Union, has been very generally taken up by both the daily and weekly press. It is only in this way that a public sentiment can be created against the present indiscriminate slaughter of birds, which characterizes every part of the country where the birds and man come in contact with each other. The classes to whom this appeal for the life of the innocent songsters must be made are so widely different that probably on no other issue could they be named in the same connection. It is odd that the first and strongest appeal must be made to those whom we would suppose to be the natural defenders of the birds, the women of the country.

Yet so remorseless has been the war which the gentler sex has indirectly waged against these feathered visitors, that it has acquired the unenviable title of belonging to the "dead-bird wearing gender." It is estimated that five million birds are annually sacrificed for the personal decoration of the women of the United States. If every woman who contemplates decorating her next bonnet with stifled songsters would reflect that with thousands of others indulging in the same barbarous fancy, there will soon be no birds left to gratify either personal vanity or the better love of bird companionship before they have been rendered mute and lifeless, we think it would be easy to persuade her to substitute some more fitting decoration. Other causes are also helping to depopulate our groves and forests. Many birds which do not secure protection under the game laws now existing in nearly every State are being killed for food, and each year the list is extended. Our markets are already stocked with such great variety that there seems absolutely no excuse for this slaughter.

Not only are the adult birds destroyed, but the eggs are consumed in large quantities. And then there is the traditional small boy, whose instinct is to kill, if we are to believe what we are told—but there is another side to his nature. If his sympathies are once enlisted, he is a most loyal champion, and will do good battle in the cause to which he devotes himself. If the bird protection societies can win over this impetuous little advocate, they will lose a very destructive enemy and gain a very active friend.

Though the list of bird destroyers is by no means exhausted, we have space only to refer to one other class, those who collect for scientific purposes. This is perfectly legitimate, and requires a much less number of birds than is usually accredited to it. In all the museums of the country, both public and private, there cannot be more than half a million birds—one-tenth the number annually demanded by fashion. There are also egg collectors, whose apparent cruelty in robbing the nest of its treasured contents is entirely justified by the strictly scientific use to which the eggs are put. But there are just now numbers of pseudo-scientists all over the country, who are influenced simply by the prevalent mania for collecting anything and everything, without regard to their ability to make it valuable. These people kill birds by the score, and steal eggs by the dozen, and make a collection, but the absence of classification or an attempt at completeness prevents it from having any value whatever.

So many reasons conspire to make a plentiful bird life desirable, that the question of why we should protect it seems to answer itself. For purely utilitarian reasons, as a check upon the insects harmful to vegetation, the birds deserve our protection. Even those birds which have themselves a bad reputation as garden marauders destroy more insect enemies than garden products. Not one can be shown to be wholly injurious.

And as a pleasing and beautiful form of natural life, nothing surpasses the sociable little house birds or the wilder dwellers in the woods. To have broad meadows and country lanes devoid of the cheerful song of birds and noisy only with the monotonous whir and buzz of insect life, would be to rob them of one of their greatest charms.

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ENGINEERING INVENTIONS.

A switch lock has been patented by Mr. Hobert B. Potter, of North Adams, Mass. Combined with a switch-throwing lever is a sliding bar for locking it, a rack on the bar and a pinion engaging therewith, a lever with chain links for turning the pinion, and other novel features, to lock a switch and prevent its being turned, and to set a signal as desired.

AGRICULTURAL INVENTIONS.

A plow has been patented by Mr. Thos. E. Jones, of Center Star, Ala. The construction is such that the plows used may be shovel plows, turn plows, or scrapers, or a single plow may be used, so the plow may be used for the several operations necessary in preparing the ground and cultivating the crop.

A farm gate has been patented by Mr. Edwin H. Penfield, of Santa Barbara, Cal. The body of the gate is hinged upon an upright rod that passes through the upper and lower bars, and is held in cross pieces secured to posts set in the ground diagonally to each other across the line of the fence, the gate being opened and closed by a suitably arranged pivoted lever, cord, and pulleys.

MISCELLANEOUS INVENTIONS.

A combined square, miter, and circle scriber has been patented by Mr. William F. Seargeant, of Marshall, Mo. It consists of a graduated blade, with a beveled or miter point, mounted in a slotted stock, in the heel of which is a screw point, while an adjustable block, also carrying a point, is mounted in the slot formed in the stock.

A beehive has been patented by Mr. William M. Myers, of Hannibal, Mo. It may be made of earthenware, wood, or metal, but preferably of earthenware, as having no cracks or crevices in which moths can lay their eggs, the invention covering novel features in the construction and combination of various parts of the hive.

A creamer has been patented by Mr. Nathan Yingst, of Reistville, Pa. This invention provides a simple form of cabinet in which milk may be thoroughly and quickly cooled and the heat thereof carried directly out of the casing, each of the parts being especially formed with a view to conveniently and expeditiously cleansing the same.

A filter has been patented by Mr. Jos. C. Higgins, of New Brunswick, N. J. The special design of this filter is such that the sand or other filtering material will not be packed while being cleaned, but kept loose and disintegrated during the cleaning operation, while the filter is simple in construction and effective in operation.

A knitting machine has been patented by Mr. Freeman A. Calley, of Pawtucket, R. I. The construction is such that the machine may be conveniently adjusted to knit with one or two threads, and the length of stitch can be easily regulated, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

A washing machine has been patented by Mr. Fredrick E. Richardson, of Uniontown, Ia. It is of that class of machines having a collapsible cage for receiving the clothes, and its construction is such that the clothes are forced through the suds in the tub or box in different directions and thoroughly agitated, without being rubbed, pulled, or beaten.

A flying target has been patented by Mr. Franklin J. Curran, of Stanford, Ky. It may be formed of glass, clay, or other fragile material, and is formed with peripheral notches, each pair being arranged a distance apart less than half the circumference of the target, and the target having circular ribs or ridges so that the shot will not glance off.

A machine for winding wire upon hose has been patented by Mr. Joseph A. Coultaus, of Brooklyn, N. Y. Its construction is such that as the hose is fed through an aperture it is automatically turned, and the wire feed is arranged to automatically wind wire spirally around the hose, the apparatus being designed for various sizes of pipe or hose, to give them a protecting covering.

A lock for pocket books has been patented by Mr. Gustave Hood, of Newark, N. J. It has a sliding plate and outer stationary plate, both having rounded corners, with various novel features of construction to make such a lock which shall be neat in appearance, occupy but small space, conveniently operated, and leave no projecting parts liable to wear or tear the pockets.

A safety lock for fire arms has been patented by Mr. Henry C. Waldecker, of Austin, Minn. A locking rod has its operating plate projecting beyond the face of the butt, and has an arm or projection, and a locking bolt is arranged to engage such projection and lock the operating plate, to prevent the premature discharge of guns by keeping the trigger locked until the gun is placed against the shoulder for firing.

A signal lantern has been patented by Mr. George Wells, of Annapolis, Md. It has an outer opaque cylinder or mask which normally rests around and in front of the lamp, and which is lifted away from the lamp by the elevation of each or all of several colored cylinders, to provide lights of different colors by means of concentric sliding glass cylinders, alternately slid over or around the flame.

A fifth wheel gear for vehicles has been patented by Mr. John G. Ebken, of Pittsburg, Pa. Combined with a vehicle box is a hanger projecting downward, a bar secured to the bolster and having a roller running on the hanger, and secured to the bar and to the upper fifth wheel section, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

A rotary ventilator has been patented by Mr. Edwin F. Briggs, of Brooklyn, N. Y. This invention covers a novel construction of the rotating wheel of the ventilator, whereby its central position is made more effective, with means for varying the angular positions of the vanes, and improvements in the frame and boxes or bearings for carrying the wheel shaft or spindle.

A billiard table leveler has been patented by Mr. Ernst A. Hornbostet, of Oskaloosa, Iowa. It is a device to be placed under the foot of each leg of the table to be leveled, when by turning a worm fitting in a socketed crank arm, the desired adjustment may be made, the device being also applicable for use in connection with printing presses and other heavy articles.

A telephone receiver has been patented by Messrs. John E. Dann and John Lapp, of Honeoye Falls, N. Y. Two horseshoe electric magnets are employed, arranged right and left from the diaphragm on its rear side, both armatures being connected with the diaphragm by rigid rods, so that both act simultaneously on the diaphragm to vibrate it as forcibly as possible, in order to give increased loudness of tone.

Telephone transmitters form the subject of two patents also issued to the above inventors. One of the forms is intended more particularly as an improvement upon instruments of the Reis type, having two small electrodes that are free to vibrate in connection with the diaphragm, and using a local circuit acting through the electrodes reversely to the main circuit, in order to neutralize the adhesion of the electrodes, and facilitate the required rapidity of vibration. The other form of transmitter is especially designed for the production of a loud-speaking instrument, capable of operating with a minimum expenditure of battery power or electromotive force, for which purpose a new and simple construction of the diaphragm is provided, with a novel mechanism co-operating therewith, the diaphragm having a central conical portion, the diameter of the base of which cone shall equal or slightly exceed that of the contiguous inner end of the mouth piece.

NEW BOOKS AND PUBLICATIONS.

A REPORT ON THE TERMINAL FACILITIES FOR HANDLING FREIGHT OF THE RAILROADS ENTERING THE PORT OF NEW YORK. By Gratz Mordecai. New York: *Railroad Gazette*, 1885.

Mr. Mordecai's report was prepared for the *Railroad Gazette*, and gives a careful account of the terminal works and business of the different railroads centering in New York. As the problem of handling the immense amount of freight daily brought into a metropolitan port is one of large importance, this study of the facilities as they now exist will, it is hoped, lead to an improved arrangement of freight houses and yards which will add to the convenience of both carrier and shipper. The author advocates the establishment of a union terminal company for the handling of the greater portion of in-bound and out-bound freight, believing that such a system would give increased economy in time and labor. His report is well worthy the attention of railroad men.

TABLES FOR CALCULATING THE CUBIC CONTENTS OF EXCAVATIONS AND EMBANKMENTS. By John R. Hudson, C.E. New York: John Wiley & Sons, 1886.

The formula developed by Mr. Hudson is quite as accurate as the "prismoidal formula," to which engineers usually have recourse in calculating the cubic contents of excavations and embankments, and has the advantage of being much shorter and simpler. It is particularly adapted to use with tables, and therefore permits greater ease and rapidity in the calculations. Two sets of tables are given: one showing the cubic contents of a level cross section for a given center cut or fill, and specified road bed and side slope; the other, the corresponding contents of the side triangles to be added or subtracted as they are above or below the level cross section. With these tables and a cross section book, one can easily and quickly calculate the cut or fill on each 100 foot section of proposed road, and can be very confident that all the work is accurate, for the tables have been prepared with great care.

Barrowcliffe's Table of Trade Discounts has been prepared with special reference to persons who are much occupied in setting such a price upon goods that it will allow a certain trade discount and still leave a profit over and above the original cost. The table gives the fractional amount to be added to the net selling price so as to permit a discount of from one to ninety-five per cent, and will be found useful to persons who have much of this sort of work to do.

Messrs. Otis Brothers & Co., of New York city, have recently published a large and handsome descriptive catalogue of their standard hydraulic passenger and freight elevators, steam and geared belt elevators, and steam hoisting engines and hydraulic hoists. The dimensions to which their business has grown from the limited proportions indicated by the small factory they occupied in 1852 fully accord with the increasing use of these conveniences for reaching the upper floors of high buildings.

The Pope Manufacturing Company, of Boston, in their "ninth annual greeting," just issued, present a catalogne of their productions which shows that special improvements are constantly being made, although their bicycles and tricycles had formerly seemed to lack nothing necessary to make a perfect machine. The use of these means of locomotion appears to be steadily on the increase.

Received.

THE PRACTICE OF THE IMPROVEMENT OF THE NON-TIDAL RIVERS OF THE UNITED STATES. By Captain E. H. Ruffner, U. S. A. New York: John Wiley & Sons.

BUILDERS' BLANKS FOR ESTIMATING MATERIAL AND LABOR. By I. P. Hicks, Atlantic, Iowa.

TEMPERANCE TEACHINGS OF SCIENCE. By A. B. Palmer. Boston: D. C. Heath & Co.

DRAINAGE FOR HEALTH; OR, EASY LESSONS IN SANITARY SCIENCE. By Joseph Wilson. Philadelphia: P. Blakiston, Son & Co.

Special.

TWO CASES IN VIRGINIA.

In 1884 the mails brought to Philadelphia a grateful letter from a gentleman of Lynchburg, Va., who told the story of the cure of his daughter by the use of the Compound Oxygen Treatment after being a sufferer from inflammatory rheumatism, beginning in her fourth year and lasting nine years. His letter was as follows:

"DRS. STARKEY & PALEN: Dear Sirs: My daughter has been using your Compound Oxygen for five weeks. Within a week, she began to show signs of improvement; since then her recovery has been remarkable. I have never seen anything to equal it. The action of the heart is quiet and soft; there has been no sign of rheumatism; she sleeps sweetly all night; has a fine appetite, has gained many pounds of flesh, and has considerable color; can walk all about the house, and has paid two or three visits in the neighborhood.

"Very respectfully, C. V. WINFREE."

About the time this young lady was finding relief from her inflammatory rheumatism, another lady suffering from consumption began the treatment. She had tried other remedies without success, and the prospects for her future were gloomy indeed.

In addition to her lung troubles she was a sufferer from curvature of the spine. Now, she can write herself a comparatively healthy woman, and the happy wife of the Mayor of that city. Her story is told partly by her husband and partly in a letter from herself. We give her husband's letter below:

MAYOR'S OFFICE, LYNCHBURG, Dec. 15, 1885.

DRS. STARKEY & PALEN: Dear Sirs: In stating what your Compound Oxygen Treatment has accomplished for my wife, I am discharging a debt which I feel I owe to suffering humanity.

My wife has long been in delicate health, and since her seventeenth year has been suffering from a curvature of the spine. This greatly weakened her and occasioned much pain and excessive nervousness. Notwithstanding this, she further exhausted her strength and prostrated her health by the usual round of pleasures of the fashionable world: late hours, parties, operas, and above all the german. The result of this course was that her health was completely prostrated, her vitality exhausted, and when on a Northern trip in the summer of 1882 she contracted a deep cold, it settled on her lungs, and consumption was soon after the result.

During the early fall of 1882 she began coughing considerably; and finding that she was fast losing her strength and flesh, early in January, 1883, Mrs. Manson, then Miss Field, set out from her home in Culpeper, together with her aunt and Dr. Rixey, for Philadelphia. She was then excessively nervous, could not speak louder than a whisper, and was unable to sleep at all. She saw one of the leading allopathic physicians of Philadelphia, who told her she had consumption, and that she must leave at once for Aiken, S. C. By the middle of the month she was on her way there, and did not return until May. Though seemingly benefited for some considerable period during her stay, she had repeated spells which threw her back so much that when she returned she was much worse than when she left home. Soon after her return she went on to New York and consulted an eminent physician there, who advised the phenic acid treatment, which she continued to use during the following summer, notwithstanding its extreme severity, for some time with apparent success, though in the fall it seemed to lose its effect and she discontinued its use, returning to Aiken about the middle of November, 1884. It was then she first used the Compound Oxygen, and when I went to see her at Christmas I found her considerably improved. I was prejudiced against the remedy, and advised her discontinuing its use, which in a great measure she did. From the beginning of the year 1884 she lost ground, till by February she was ill. I was telegraphed for, and found her suffering greatly from biliousness, fever, and great weakness. I returned home to attend to some business after a six days' stay, only to be again telegraphed for. When she returned in May she was distressingly weak and thin, and though she improved some during the summer, she never was half so well as she had been the year before, and about the middle of September she took a violent cold, which confined her to her bed and promised very speedily to end her life. Indeed, for one or two days we thought she would not live to see another; she did, however, rally slightly, and toward the end of the month insisted on going to Philadelphia to try the Compound Oxygen Treatment. I opposed the plan, because I thought she could only live a very little while longer, under any circumstances, and a trip to Philadelphia would only wear out the sooner her little remaining strength; besides, I did not think the Compound Oxygen had done her any good at home, and I did not think she stood any better chance by going there, but she clung to the idea as though it were her last hold on life. Finally I consented to her going, only because I thought she would be better satisfied, and not because I had the slightest hope of her improvement. In her first letter after seeing Dr. Starkey (it was only a few lines scrawled with a pencil) she wrote me that Dr. Starkey said she would have to stay there two weeks before he could say whether the treatment would benefit her. Before the time had elapsed she was feeling much stronger, and her appetite was far better, and by Christmas she could walk a dozen blocks. She remained in Philadelphia till April, having during that time but one bad turn, which, however, threw her back considerably. Since her return my wife has used the Home Treatment, with continued benefit. Her weight in January, 1884, when she had been with you three months, was ninety-five and a half pounds, and that was a great improvement on her condition when she went to you. The last time she was weighed here her weight was one hundred and fifteen pounds. When she went to Philadelphia, she could scarcely walk across the floor without assistance; she can now walk a mile and ride horseback for five miles. She then coughed nearly all the time, with a good deal of expectoration. Her cough is now much better, though it still clings to her, and the quantity of expectoration is comparatively small.

Her great improvement seems to me almost miraculous, and I attribute it to the Compound Oxygen, aided by a systematic, prudent life, and the abandonment of drugs.

I fear I have written much more fully than you desired I should, but I have hoped that what I have said would be of some benefit to suffering humanity. With kindly remembrance, I am,

Very truly, your friend,
N. C. MANSON, JR."

There are very many people interested in the treatment which has done so much for these two ladies in Virginia. If you wish fuller information send to Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia, for their treatise, which is sent free to every applicant.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Want to Buy—A patent; must be cheap, have merit; at least ten years to run. E. M. Swift, Jewett City, Conn

The Leonard hardwood, cleanable, five-walled Refrigerators have *air-tight locks*, Send for catalogue; mention paper. Refrigerator Co., Grand Rapids, Mich.

Wanted—An established manufactory wants patented articles (iron or steel) to manufacture on royalty; or would buy outright. Address Manufacturer, P. O. Box 261, Pittsburg, Pa.

See Burnham Automatic Engine adv. last and this week.

Gentleman wishes to invest several thousand dollars in manufacturing business in country. N. S. B., Box 773, New York.

Emery Wheels of unusually superior quality for wet grinding. The Tanite Co., Stroudsburg, Monroe Co., Pa.

Be a Hero in the Strife

says America's favorite poet. All very well, Mr. Longfellow, but how can you when half your time you feel sick, and do not feel well the other half? Men of noblest principles and highest aim find their efforts thwarted by disease. Night sweats, a hacking cough, and other symptoms only too plainly say consumption. Heed good advice. Try Dr. Pierce's "Golden Medical Discovery," and the bloom of health will return to your cheeks, soundness to your lungs, and you will be a hero yet.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Wanted—Superintendent for malleable iron works. Address, stating experience and references, "Malleable Iron," P. O. Box 773, New York.

Wanted—Patented articles of merit to manufacture on royalty. Electric Mfg. Co., 311 River St., Troy, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder*." A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

Wm. Frech, Sensitive Drill Presses, Turret and Speed Lathes combined, Power Punching Presses, 68 W. Monroe Street, Chicago.

Order our elegant Keyless Locks for your fine doors. Circular free. Lexington Mfg. Co., Lexington, Ky.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wanted—Salesman acquainted with the Western malleable iron and hardware trade. Address, with references, "Malleable Iron," P. O. Box 773, New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Nystrom's Mechanics.—A pocket book of mechanics and engineering, containing a memorandum of facts and connection of practice and theory, by J. W. Nystrom, C.E., 18th edition, revised and greatly enlarged, *plates*, 12mo, roan tuck. Price, $3.50. For sale by Munn & Co., 361 Broadway, New York city.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Tools, Hardware, and other specialties made under contract. American Machine Co., Philadelphia.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Crescent Solidified Oil and Lubricators. Something new. Crescent Mfg. Co., Cleveland, O.

Curtis Steam Trap for condensation of steam pipes, high or low pressure. Curtis Regulator Works, Boston, Mass.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

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Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 76.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 238.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

"Wrinkles in Electric Lighting," by V. Stephen; with illustrations. Price, $1.00. E. & F. N. Spon, New York.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Brass and Iron Working Machinery, Die Sinkers, and Screw Machines. Warner & Swasey, Cleveland, O.

Small Bench Lathes, with Countershaft, $16.00. Circular free. T. F. Welch & Co., 35 Batterymarch Street, Boston, Mass.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. F. S.—There is no difference whatever in the action of the pump or the pressure upon the valves or sides of the chamber, whether the pistons be pointed or flat. The sectional area at the sliding surface is the real measure of the pressure.

(2) H. C. D. writes: 1. Do you think it will be as economical to use a 30 horse power boiler for 20 horse power work as it would a 20 horse boiler? A. It *is* economical to use a 30 horse power boiler for 20 horse power work. 2. The gas company in this city have reduced the price of gas from $2.50 to $1.50 per M., but the reading of the meters after the reduction was much larger than before, so that it almost counterbalanced the reduction. A daily paper stated that they had increased the pressure, but I claim the reverse. Can you explain where the hitch comes in—in the pressure or the quality of gas furnished? A. By impoverishing the gas and increasing the pressure you are made to burn more gas for the required light, and by this means the company loses but little, and you are scarcely a gainer. The hitch is in both quality and pressure. 3. Is the lye sold in 1 pound iron boxes a preventive of scale in boilers? A. Yes.

(3) T. M. N.—Two balls of different weights or a solid and a hollow ball will drop in equal times in a vacuum. In air the friction will most retard the ball that has least density or is lightest in comparison with the area of its diameter.

(4) L. B. writes: I wish to run a light upright saw with a crank and pitman. Is there any way (patented or not) whereby I can get two down cuts of the saw with one revolution of the crank? A. Only by a cam or its equivalent. See Brown's "507 Mechanical Movements," which we can send post paid for $1.

(5) E. H. B. asks a simple, practical way for testing Russian iron, so as to distinguish readily between the genuine article and the many inferior imitations that are in the market. A. The genuine article is known by its fine black luster and small granulation of the surface in reflected light. Otherwise, by its toughness in bending with and across the grain.

(6) J. W. S.—Choke bore is a very slight decrease of diameter at the muzzle of shotguns, for the purpose of preventing the excessive spread of the shot. When properly made, it commences from ¾ inch to 1 inch from the muzzle. Rifles are not choke bored, but slightly taper bored. A load rides easiest at about two-thirds the distance from fore toward the after wheels.

(7) C. F. U. asks: Which is most economical of fuel—a boiler made after the pattern of a locomotive boiler, without jacket, with shell exposed to the atmosphere, or a common stationary boiler incased in a brick wall with brick furnace? A. We consider the brick-set horizontal tubular boiler the most economical in fuel, and most satisfactory in steaming qualities as well as safety.

(8) J. C. B.—For a soap to clean clothes without rubbing: Take 2 pounds sal soda, 2 pounds yellow bar soap, and 10 quarts water. Cut the soap in thin slices, and boil together 2 hours; strain, and it will be fit for use. Put the clothes in soak the night before you wash, and to every pailful of water in which you boil them, add a pound of soap. They will need no rubbing, but merely rinsing.

(9) C. W. R. asks how to make a good pomade for the hair. A. Take of castor oil 1 pound avoirdupois, pure white wax 4 ounces, melt them together, and then add oil of bergamot 2½ drachms, oil of lavender (English), ½ drachm, essence royale. Stir the mixture while cooling.

(10) H. P. G.—See Henderson's formula for making gelatine emulsions in the SCIENTIFIC AMERICAN of November 8, 1884, page 293. For sensitizing albumen paper, see Newton's solution, page 65, SCIENTIFIC AMERICAN of August 2, 1884.

(11) B. O. asks how to make mocking-bird food. A. Hempseed 3 parts, toasted wheat bread 2 parts, maw seed 1 part, ox heart 1 part. Boil the ox heart well in water, cut it small, and place it in a pan in an oven, where it must be allowed to become perfectly dry and crisp. All the ingredients must then be thoroughly mixed and ground in a mill to coarse powder.

(12) G. B. M. writes: 1. Can you give me a formula for mixing paint suitable for painting wire cloth green—one that will dry quick and hard and not easily crack off, and be glossy as if varnished? A. It will be found most satisfactory to purchase your paint ready prepared from some reputable house rather than to attempt its manufacture yourself. A mixture of three-fourths zinc white with one-fourth white lead, to which a little drier has been added, will be found to answer quite well. Coloring matter to suit is ground in with the above. 2. How to mix and apply oil to prevent wire cloth from rusting by long standing? A. Use raw linseed oil.

(13) W. A. K. asks: 1. Are the glass tubing and rods, etc., used by traveling glass blowers any different or more easily melted and worked than ordinary glass? A. The glass referred to is ordinary lead glass, and is similar in composition to the common white glass made in this country. 2. What metal would best resist the corrosive action of gas, the metal being used for lining cornice, water troughs, and water conductors upon gas works? A. Cast iron or lead is much better than tin. You might coat the tin with asphalt.

(14) W. J. H. desires (1) a recipe for making bay rum in small quantities. A. Take 2 pounds of leaves of the Myrtus acris, ½ pound cardamoms, 2 ounces cassia, 1½ ounces cloves, and 9 quarts rum. Distill 1½ gallons. Bay rum may be colored with tincture of saffron or with a mixture of equal parts caramel and tincture of turmeric. 2. Also a recipe for office mucilage. A. Mix 3 ounces gum, 1 ounce acetic acid, 1 ounce white sugar, and sufficient water.

(15) J. D. B. asks if one's eyes are open or shut when walking in sleep. A. Both conditions are known, but principally with the eyes open.

(16) L. T. R. desires some simple method of detecting the adulteration of spirits of turpentine by the mixture of petroleum naphtha. A. Test its bloom by dropping on a black glass plate, or test its solubility in absolute alcohol. The turpentine dissolves in this reagent, while the petroleum naphtha does not.

(17) C. S. A. writes: I have some pieces of steel that have been nickel plated, then soldered to a piece of tin. I find the nickel of the steel piece very much stained from the muriatic acid used in soldering. Is there any liquid article or compound that will restore the nickel to its former brightness? A. The nickel plating is porous. The soldering acid penetrates to and oxidizes the steel, which stains the nickel plate. We have not succeeded in recovering the luster of nickel plate that has been thus treated. Soldering should have been done with resin, and cleaned with turpentine or alcohol.

(18) H. M. N. writes: In Newton's law, "all bodies are attracted to each other directly as their mass, and inversely as the square of their distance;" do you understand the "distance" to be the distance between the centers of gravity or the distance between the most adjacent particles? A. If the mass of the body is intended, then its center of gravity is the measure of the distance. If the atoms of a mass only are considered in their relation to each other, then each atom is the measure of any distance.

(19) E. A. W.—The Wilkes exploring expedition, as also several English expeditions, has skirted the Antarctic polar land, and found it impenetrable. The north pole has elicited more attention from the scientific world from its nearness and interesting detail of distribution of land and water, as well as the evidence of an open polar sea, which does not seem to be the case at the south pole.

(20) A. D. O. asks how to find the azimuth of a place. A. Obtain the true meridian by corrected observation of the pole star, and from this take the departure with a theodolite or compass if the place is in sight. If not, make a triangulation or series of triangles reaching to the place sought with a theodolite. This will require a trigonometrical computation and geodetic correction for establishing the true azimuth.

(21) H. J. H.—As you are a machinist and blacksmith, it is supposed that you know how to weld steel and iron together. The welding of two pieces of cast steel is a very difficult and uncertain matter, and depends very much upon the grade of steel, the low grades or coarsest steel giving the best results. The welding can be facilitated by placing a thin piece of good iron in the weld between the pieces of steel, using borax only. The piece of iron may be welded to one piece first, then give the iron facing the strongest heat. Work the steel well under the hammer after the weld is completed, to fine the grain.

(22) C. W. W. writes: In a target pierced by 12½ inch projectile, what becomes of iron occupying space through which projectile passed? A. It is torn and bent back if the iron is tough; or a piece punched out and carried with the ball from brittle plates.

(23) A. D.—Suction is not strictly a scientific term, yet it is in common use in mechanics, hydraulics, pneumatics, etc., as applied to the act as well as the appliance for producing decreased atmospheric pressure. Custom has sanctioned its legitimate use. See Webster unabridged.

(24) D. L. V. N. writes: We received a new church bell, 400 pounds weight, hung in such a shallow yoke that about two-thirds of its weight is below the axis. The result was the bell was hard to ring, and strokes of hammer too close or in too quick succession for such a large bell. We bolted 25 pounds of iron on the upper portion of rope wheel, which has improved it greatly. There is a bell of same weight near here which strikes less rapidly (rings easier), and consequently has more prolonged and sonorous sounds. Why is there this difference? Should we add more weight to top of wheel? A. The weighting of the wheel to balance the bell is admissible, but tends to deaden the sound. Better send to the makers of the bell for a proper yoke. The sonorousness of bells depends so much upon their composition and form that we could not tell you, in exact terms, why or what is the cause of the difference. The bell founder may have made a blunder in the form of the bell as well as in the yoke.

(25) G. B. E. asks the mixture with which to brown gun barrels. A. Chloride of antimony mixed with a little olive oil. Add a few drops of nitric acid to sharpen its action, if required. Another: sulphuric acid ½ ounce, sweet spirits niter ½ ounce, blue vitriol 2 ounces, alcohol 1 ounce, tincture of the chloride of iron 1 ounce, water 40 ounces; add alcohol last.

(26) R. B. R. asks the best and simplest method of keeping cistern water as soft as possible. A. Paraffine rubbed on the dry walls and bottom of a cistern and melted into the cement with a hot iron is the most effectual method of keeping the water soft or free from lime. Cisterns, when plastered with pure Portland cement, generally give satisfaction.

(27) B. J. asks how they get the different tones in a single bell chime whistle. A. By dividing the bell into two or three parts which are unequal. This is the subject of a patent.

(28) L. L. asks: 1. What would be the expansion of an inch bar of wrought iron five feet long under a temperature of 300° steam heat? A. $\frac{12}{100}$ of 1 inch. 2. What would be the difference between the expansion of the above bar of wrought iron and a cast iron pipe of the same length under the same temperature? A. $\frac{1}{100}$ of 1 inch. 3. What, if any, would be the difference between the expansion of cast iron and homogeneous steel casting? A. Slightly less than $\frac{1}{100}$ of 1 inch.

(29) J. H.—Scrap brass varies so much in its composition that we cannot give you any intelligent answer how to use it in casting without inspection. The bright yellow brass may be from 6 to 8 ounces zinc to the pound of copper. By melting 1 pound of copper with 1½ pounds of such yellow brass, you will make what is called a 3 to 4 ounce brass, which is very rich in color. For dark colored scrap we cannot advise, as it probably contains lead and iron.

(30) T. H. C. asks: 1. Has a miner any legal right, after going below the surface, to undermine a neighboring claim? A. It will depend entirely upon the nature of the deposit he is working. If it be a true fissure vein, the United States Mining Law gives him the right to follow it as far as he chooses between the two vertical planes determined by the end lines of his claim; provided, however, that his surface lines include the highest point or apex of the outcrop of the vein. If he is working a deposit or seam, he is limited by the vertical planes passing through both his side and end lines. 2. What is the difference between the rules governing the mining of coal and the different metals? A. As coal is always a regular member of the geological formations, a seam, and not in any sense a vein—though the latter term is often improperly used—the miner is always limited by the vertical planes passing through his surface lines. He is open to an action at law if at any time he removes the coal from beneath a neighbor's property.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

March 30, 1886,

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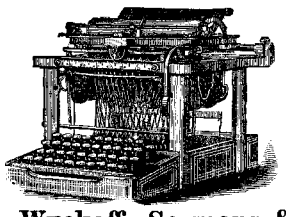

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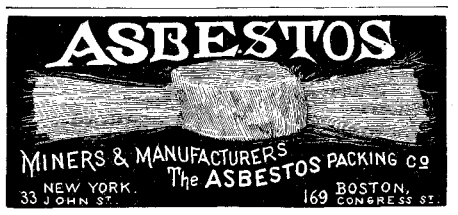

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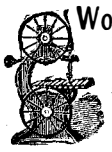

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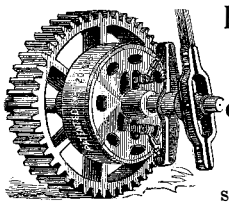

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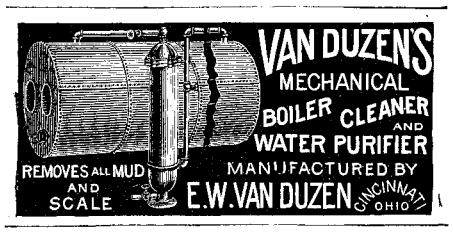

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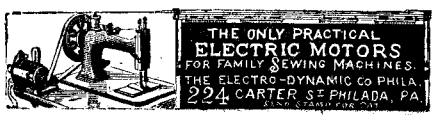

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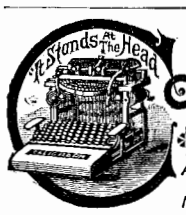

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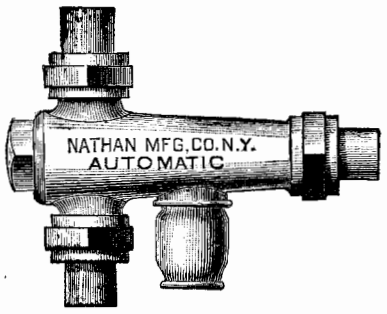

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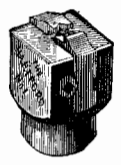

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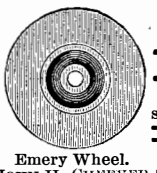

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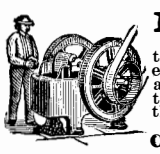

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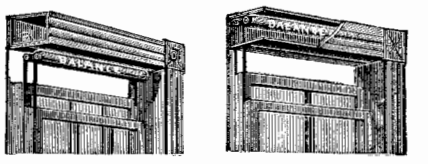

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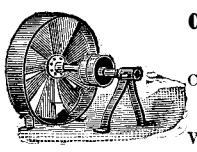

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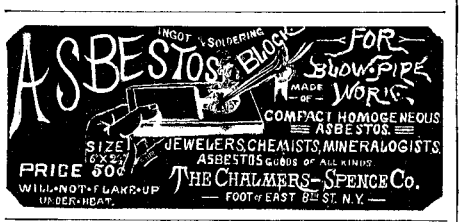

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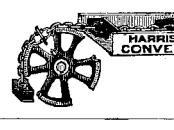

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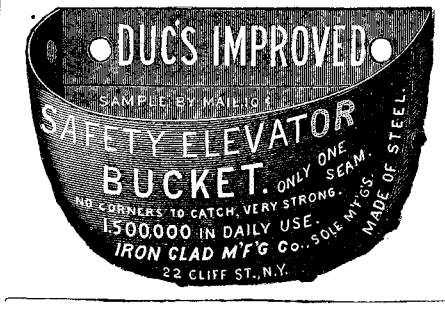

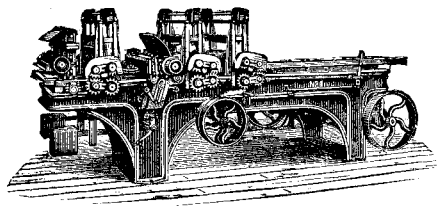

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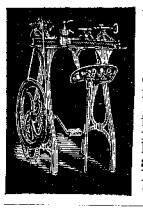

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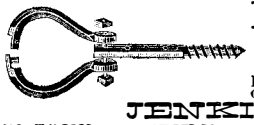

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